PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 10 – Papers for 1963

December, 1963

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 10 – Papers for 1963

December, 1963

FOREWORD

This is the tenth volume of proceedings of the Society which has been published since its founding in 1938.

The first volume published in 1941 included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume published in 1946 included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer, edited that edition.

The third volume published in 1953 included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years of 1950 through 1953. Volume five contains papers for the years of 1954 and 1955. The sixth volume included papers presented during 1956. The third through the sixth volumes were edited by Dr. Arthur G. Keller.

The seventh volume, which is in two parts, 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth and ninth volumes contain papers presented during 1961 and 1962 respectively. These volumes, as well as this, the tenth volume, which includes papers for the year 1963, have been compiled by the writer.

Denver T. Loupe
Denver T. Loupe
Secretary-Treasurer

December, 1963

I N D E X

CANE QUALITY DETERMINATION IN LOUISIANA

John J. Seip
Chemical Engineering Department
Louisiana State University

GENERAL

During the June meeting we covered different methods of cane quality determination in general usage.[1] This material was a preliminary to the specific subject of cane quality determination in Louisiana. Firstly, let us define cane quality determination to include:

1. Sampling - that is withdrawing the sample of cane from the shipment.
2. Testing - or analyzing the sample.
3. Evaluating the test results in terms of the quality of the cane.

Next we might briefly review the different methods of cane quality determination which were covered previously in detail.

Sampling Cane in the Carrier (Indirect Cane Quality Determination)

With the exception of Louisiana and Hawaii, cane is predominately hand harvested. Cane washing installations at the factory are not present and cane is sampled in the carrier.

The Java Ratio: In this earliest, simplest, and still very common method of direct cane quality determination, cane quality is determined from crusher juice imspections.

$$\underset{\text{(Grower)}}{\text{Sucrose \% Cane}} = \text{Java Ratio} \times \underset{\text{(Grower)}}{\text{Sucrose \% Crusher Juice}}$$

where: $$\text{Java Ratio} = \left[\frac{\text{Sucrose \% Cane}}{\text{Sucrose \% Crusher Juice}}\right]_{\text{Factory}}$$

The Java Ratio directly - or with modifications - is used in South Agrica, Jamaica, and the Philippines. In addition to the Java Ratio, various other methods of cane quality determination also utilize the crusher juice inspections.

The Addition of Fiber: From the fiber content of a cane sample, the quantity of extractable juice in the sample may be inferred. Most systems which use fiber in cane evaluation, utilize formulas in which the yield of raw sugar is predicted from the crusher juice inspections and the fiber content of samples of cane removed from the carrier. Such systems are used in Australia, Reunion, and Mauritius.

Sampling Cane Before the Carrier (Direct Cane Quality Determination)

The increasing incidence of mechanical harvesting has necessitated consideration of washing cane in the carrier. The expedient of washing cane necessitates removing samples before the carrier. Unfortunately, the majority of cane sampling systems for cane payment are still wedded to crusher juice samples, and we thus have an anamoly where economic considerations call for mechanical harvesting with subsequent cane washing at the carrier, but the cane sampling systems cannot accommodate this expedient. Correspondingly, we find that most systems of direct cane quality determination for cane payment are still in the experimental stage. Other such systems which should find application in the direct method, are still being utilized primarily for agronomic yield studies.

The Cold Water Extraction Process: The cane sample is chipped and then extracted with tap water in a container with rapidly rotating blades. Sucrose or pol. Brix, and fiber per cent cane are determined from the residue and extract. Such systems are in the experimental stage in

Queensland (Australia), and in South Africa. Only in Hawaii is this system used commercially.

The Three-Roll Sample Mill: The Houma, Louisiana, USDA Experimental Station uses a small hydraulically loaded three-roll sample mill for varietal yield studies. This mill is a prototype of the large commercial three-roll mill.

THE LOUISIANA SYSTEM

The practice of washing the cane entering the carrier, the small size of the individual cane deliveries relative to the capacity of many of the factories, and the fact that most cane is delivered during the daylight hours - these factors have resulted in the almost universal use of the three-roll sample mill for direct cane quality determination for cane payment. Briefly, the Louisiana system includes:

1. Removing a sample for trash determination from which net cane is calculated.

2. Removing another sample for processing in a three-roll sample mill.

3. From the inspections of the juice extracted in the sample mill, determining the quality of the net cane in terms of the normal juice sucrose and purity.

Samples are removed from the cane conveyance or the feeder table by hand or by mechanical grab. The latter equipment is a hydraulically operated device which is capable of handling a sample of 40 to 120 pounds of cane. Although sampling by coring (in which a core is removed from the bundle by a rapidly rotating toothed cylinder) was investigated at the Audubon Sugar Factory in 1957 and 1958, this expedient has not found commercial application in the state. However, it has subsequently been adopted in Hawaii.

The frequency of sampling for trash and for sucrose and purity - and the prescribed methods of testing - are specified in the procedure published annually by the Sugar Division titled Sampling, Testing, and Reporting Procedure to be Followed by Louisiana Sugar Mills Under the Sugar Act Determination. Practically, because of the wide variation in factory capacity and in the number of growers delivering to each factory, the sampling frequency of the individual factories varies. This is illustrated in Table 1 which shows for 14 factories the number of shippers supplying the factory, the average number of shippers delivering daily, the average frequency of sampling for trash and for sucrose and purity, and the cost of the trash and the sucrose and purity tests.[2]

Trash: If the bundle is placed on the feeder table, a 50-100 pound is removed by mechanical grab or by hand. If the bundle is placed on the ground, a 50-100 pound sample is removed by hand. The gross cane is weighed, detrashed, and the net cane is weighed. From these data the per cent trash is determined.

Sucrose and Purity: Several methods are used in sampling for sucrose and purity:

Individual Stalk Samples: Several stalks of cane are removed from the conveyance and composited with other samples from the same grower. The composite is ground in the sample mill at the end of the day. Quite commonly, every truck entering the cane yard is sampled in this manner.

Mechanical Grab: A sample is removed from the opened bundle on the feeder table and ground directly. It is obviously impossible to sample every truck in this manner; hence, the results of the sample are applied

to several truck deliveries.

Hand Grab: Many of the factories have increased capacity to the extent that the feeder tables and carrier cannot be adapted to sampling by mechanical grab on the feeder table without the expenditure of considerable money. As a compromise, hand grabe of 20 to 40 pounds of cane are removed from the opened bundle of cane on the ground. These samples are ground directly.

Samples from the Trash Determination: From the trash mechanical grab samples, individual stalks are removed and composited or a hand grab is removed and ground directly.

Types of Sample Mills: The type of sample mill varies widely throughout the state. All are three-roll and motor driven; however, at one extreme we find old fixed setting syrup mills which can handle at the most two to three stalks of cane at a time. At the other extreme are hydraulically loaded mills which can handle as many as 10 to 15 stalks at a time. The extraction severity varies correspondingly. With the less efficient mills the juice extraction ranges from 20 to 35 per cent on cane, while some of the highly efficient mills show a better extraction than the commercial crushers. Several factories use two three-roll mills in tandem to obtain greater extraction severity.

Testing and Evaluation

The juice samples from the sample mill (as well as those from the factory tandem) are analyzed for apparent sucrose (pol) by the Horne's dry lead method and for Brix by hydrometer. (Technically, while we use the term sucrose in referring to cane quality in Louisiana, the value is properly pol in the correct sense of the word.)

The Normal Juice Concept: Cane quality in Louisiana is based on the concept of normal juice, and the grower is paid on the basis of his normal juice sucrose and purity. Normal juice is defined as juice extracted from sugar cane by a mill tandem when no maceration water is used. Since maceration water is used to increase the milling efficiency, it is necessary to calculate the factory normal juice inspections by the application of factors to the sample mill and crusher juice inspections. Similarly, the grower's normal juice quality is determined from factors which relate the average sample mill juice quality to that of the factory normal juice.

Since the grower's normal juice quality is related to that of the factory, let us first discuss the determination of the factory normal juice quality through the various factors which are involved.

The Dilution Compensation Factor: The use of wash water on the carrier necessitates determination of "undiluted" crusher juice quality - or what the crusher juice would have been without the addition of wash water.

$$\text{Factory "Undiluted" Crusher Juice Brix} = \text{Dilution Compensation Factor} \times \text{Sample Mill Juice Brix}$$

where: the sample mill juice Brix is a 24-hour average and:

$$\text{Dilution Compensation Factor} = \frac{\text{"Undiluted" Crusher Juice Brix}}{\text{Sample Mill Juice Brix}}$$

as determined from periodic milling tests on cane with no wash water.

The Dry Milling Factor: The factory normal juice Brix is determined from the "undiluted" crusher juice Brix and another factor:

$$\text{Factory Normal Juice Brix} = \text{Dry Milling Factor} \times \text{Factory "Undiluted" Crusher Juice Brix}$$

where: $\text{Dry Milling Factor} = \dfrac{\text{Normal Juice Brix}}{\text{"Undiluted" Crusher Juice Brix}}$

Either the dry milling factor of 0.97 is used or the factory may run periodic dry milling tests in which no maceration and wash water is used.

The factory normal juice sucrose is then determined by the following calculation:

$$\text{Factory Normal Juice Sucrose} = \text{Factory Normal Juice Brix} \times \text{Factory Mixed Juice Purity}$$

The grower's normal juice sucrose and purity are calculated from the sample mill inspections and factors which relate the average sample mill results to the factory normal juice quality.

<u>The Sample Mill Brix Factor</u>: The grower's normal juice Brix is determined from his sample mill inspections and a sample mill factor:

$$\text{Grower's Normal Juice Brix} = \text{Sample Mill Brix Factor} \times \text{Grower's Sample Mill Juice Brix}$$

where: The sample mill brix factor is determined by comparing for the same 24 hour period the average sample mill and the factory results as follows:

$$\text{Sample Mill Brix Factor} = \frac{\text{Factory Normal Juice Brix}}{\text{Sample Mill Juice Brix}}$$

<u>The Sample Mill Sucrose Factor</u>: The grower's normal juice sucrose is determined in a similar manner:

$$\text{Grower's Normal Juice Sucrose} = \text{Sample Mill Sucrose Factor} \times \text{Grower's Sample Mill Juice Sucrose}$$

where: the sample mill sucrose factor is determined in a manner similar to that for the Brix factor.

The grower's normal juice purity is then calculated as follows:

$$\text{Grower's Normal Juice Purity} = \frac{\text{Grower's Normal Juice Sucrose}}{\text{Grower's Normal Juice Brix}} \times 100$$

The grower's cane quality is determined in terms of standard cane by means of the following cane quality formula which relates the standard of cane quality as standard cane to his normal juice purity and sucrose.

$$\text{Grower's Standard Cane, Tons} = \text{Net Cane, Tons} \times \text{Quality (Sucrose) Factor} \times \text{Purity Factor}$$

where: Net Cane is determined from the trash inspections.

The quality factor relates the grower's normal juice sucrose to standard cane. (12.00 sucrose % normal juice is unit standard cane.)

The purity factor relates the normal juice purity to standard cane.

The quality and purity factors are determined from tables which accompany the annual Cane Price Determinations. These factors were developed many years ago, and theoretically reflect the actual raw sugar yield at the corresponding normal juice sucrose and purity levels.

The payment to the grower for sugar is subsequently determined from a cane payment formula:

Payment to Grower	= Grower's Standard Sugar Cane	x Basic Price For Standard Sugar Cane	plus	Cane Transportation Allowance

where: the basic price for standard sugar cane is based on the sugar cane pricing factor and the weekly or season's average price of raw sugar as determined by the New Orleans Sugar Exchange. The sugar cane pricing factor sets the distribution of returns for sugar between the grower and the factory and is published in the annual fair price determinations.

<u>Example</u>:

Dilution Compensation Factor: 0.9601
Dry Milling Factor: 0.9700

24-hour average sample mill Brix: 18.05
24-hour average sample mill Sucrose: 14.40

"Undiluted" Crusher Juice Brix: 18.05 x 0.9601 = 17.33
Factory Normal Juice Brix: 17.33 x 0.9700 = 16.81

Factory Mixed Juice Purity (from the control records): 76.21
Factory Normal Juice Sucrose (as calculated): 16.81 x 0.7621 = 12.81

Today's Sample Mill Brix Factor: 16.81 ÷ 18.05 = 0.9313
Today's Sample Mill Sucrose Factor: 12.81 ÷ 14.40 = 0.8896

Average of six preceeding days' Sample Mill Brix Factor (assumed): 0.9219
Average of six preceeding days' Sample Mill Sucrose Factor (assumed): 0.8800

Grower A Sample Mill Brix (from his sample inspections): 18.01
Grower A Sample Mill Sucrose (from his sample inspections): 14.20

Grower A Normal Juice Brix: 18.01 x 0.9219 = 16.60
Grower A Normal Juice Sucrose: 14.20 x 0.8800 = 12.50
Grower A Normal Juice Purity: 12.50 ÷ 16.60 x 100 = 75.30

Grower A Delivery: 204.360 Gross Tons
Grower A Trash (from his trash test): 8.5%

Grower A Net Tons: 204.360 - [204.360 x 0.085] = 186.989

Grower A Quality Factor: 1.050
Grower A Purity Factor: 0.985

Grower A Standard Tons: 186.989 x 1.050 x 0.985 = 193.393

Time does not permit a discussion of the shortcomings of the Louisiana system to include the concept of normal juice, the multiplicity of factors of doubtful accuracy, and the failure to include the amount of extractable juice in the cane. A discussion of these factors and revisions to the system which are being considered will have to be deferred until the next technical meeting.

REFERENCES

[1]Seip, John J. "A Study of Methods of Cane Quality Determination for Cane Payment," Paper delivered before the American Society of Sugar Cane Technologists, June 7, 1962.

[2]Progress Report No. 2 - A study of Sampling and Methods of Determining Sucrose, Purity, and Fiber Content of Sugar Cane. USDA Contract No. 12-25-010-558 with the Audubon Sugar Factory (Louisiana State University), P. 15.

TABLE 1

FREQUENCY AND COST OF SAMPLING

1957-58 CROP

Name of Factory	No. of Cane Shippers Total	No. of Cane Shippers Av./Da.	Testing Cane for Trash Av. Tons Cane Test	Testing Cane for Trash Av. Cost per Test	Testing Cane for Sucrose & Purity Av. Tons Cane/Test	Testing Cane for Sucrose & Purity Av. Cost per Test
A	41	26	61.15	$1.26	-	-
B	34	31	52.95	0.86	54.72	$0.87
C	36	20	43.45	0.73	73.87	1.79
D	301	120	26.48	0.74	15.97	0.46
E	568	225	33.38	0.61	11.02	0.55
F	32	21	48.85	1.30	91.61	1.04
G	220	45	29.01	1.09	29.01	0.36
H	41	20	39.30	1.08	30.92	0.42
J	44	6	61.03	0.39	-	-
K	110	80	50.74	1.48	52.21	0.64
L	185	98	43.84	1.29	14.34	2.82
M	122	34	34.32	0.67	34.32	0.65
N	204	138	23.10	1.09	5.55	0.56
O	45	24	44.11	1.410	88.81	1.47

Studies of the Physical Properties of Selected Soils in the Sugar Cane Area of Louisiana

Wm. H. Patrick, Jr., Ronald Wyatt, and E. C. Simon

This report deals with recently completed soils research in the sugar cane area of Louisiana. Two studies are covered in this report: (1) The effect of various sugar cane rotations on the yield of sugar cane and on soil organic matter and structure, and (2) chemical and physical properties of the important sugar cane soils along Bayou Teche.

The Effect of Various Rotations on the Yield of Sugar Cane and on Soil Organic Matter and Structure

This experiment was established on a Mhoon clay loam soil at the L.S.U. sugar farm in 1954. Four rotations involving sugar cane were compared as to their effect on soil properties and sugar cane yields. These rotations ranged from soil depleting to soil building cropping systems. All rotations ran in a seven year cycle. The most soil depleting rotation (Rotation 2) has three years of sugar cane followed by one year in which the land was summer fallowed. Sugar cane was then grown again for a three year period. No legumes were grown in this rotation and the cane trash was burned after harvest. This rotation returned a minimum amount of organic matter to the soil. The rotation designed to add the most organic matter to the soil (Rotation 3) consisted of four years of a white clover-dallisgrass sod followed by three years of sugar cane. After cane harvest the trash was chopped and turned under. There were two other rotations that were intermediate in their effect on soil properties. One of these rotations (Rotation 1) was similar to the first rotation described except that *Melilotus indica* was grown during the first winter of plant cane and soybeans were grown and turned

under in the year that the land was not in sugar cane (the fourth year). In this rotation cane trash was burned. The other rotation (Rotation 4) used in this study was very similar to the one just described except that the cane trash was chopped and turned under instead of being burned. A detailed listing of the treatments used in this study is shown in Table 1.

Table 1.--Description of rotation used in experiment on Mhoon clay loam.

Rotation 1: Standard Rotation with Legumes. Trash Burned.		Rotation 3: Cane Rotated with Sod Crops to Build up Organic Matter and Soil Structure. Trash Chopped and Turned Under.	
Year		Year	
1	Plant cane with _M. indica_.	1-4	Grass-white clover sod.
2	Cane.	5	Plant Cane.
3	Cane.	6	Cane.
4	Soybeans.	7	Cane.
5-7	Same as Years 1-3.		

Rotation 2: Soil Depleting Rotation. Trash Burned.		Rotation 4: Standard Rotation with Cane. Trash Chopped and Turned Under.	
Year		Year	
1	Plant Cane. No legume.	1	Plant cane with _M. indica_.
2	Cane	2	Cane.
3	Cane	3	Cane.
4	Summer fallow.	4	_M. alba_.
5-7	Same as Years 1-3.	5-7	Same as Years 1-3.

The yield and sucrose content of sugar cane from the various treatments are shown in Table 2 for the 1959 through 1961 seasons, and in Table 3 for the 1961 season. The 1959 through 1961 seasons represent the three years that sugar cane was grown following the turning under of the sod in Rotation 3. As may be seen in Table 2, the yield of sugar cane was significantly higher following the dallisgrass and white clover sod than where the

soil depleting rotations were used. However, the sucrose of Rotation 3 was lower than sucrose from the other rotations. The lowest yield of sugar cane was obtained from Rotation 2 which was the most soil depleting rotation.

Table 2.--Cane Yields and Sucrose Content. Average for 1959-61 Seasons.

Rotation	Tons per Acre	Sucrose - %*
1	33.84	11.53
2	31.23	11.58
3	35.53	10.87
4	32.35	11.23
L.S.D. at 5%	2.62	

*Weighted Mean

The yield and sucrose values shown in Table 3 for the 1961 season are similar to those listed in Table 2. The highest yield and the lowest sucrose was again obtained from Rotation 3.

Table 3.--Cane Yields and Sucrose Content for 1961 Season.

Rotation	Tons per Acre	Sucrose - %*
1	33.7	11.44
2	33.8	11.40
3	35.7	11.18
4	32.0	11.32

*Weighted mean.

The soil organic matter content and soil aggregation values measured at the end of the first seven years of the rotation experiment are shown in Table 4. Where cane trash was turned under (Rotations 3 and 4) the organic

matter content was considerably higher than where the cane trash was burned (Rotations 1 and 2). The values in Table 4 indicate that turning under cane trash may have caused a slight increase in soil organic matter content. It will be necessary to carry this experiment through another seven year cycle before definite information on this can be obtained.

Although the differences in soil aggregation were not as pronounced as the differences in organic matter content, Rotations 3 and 4 also resulted in the highest percentage of stable soil aggregates, as may be seen in Table 5. From 1959 through 1961, three years in which the plots were in sugar cane, there was a gradual decrease in aggregation for all of the treatments. Growing cane for three years obviously resulted in the destruction of many of the stable soil aggregates.

Table 4.--Organic Matter Content of Mhoon Clay Loam.

Rotation	1959	1960	1961
1	1.77%	1.83%	1.82%
2	1.72	1.79	1.85
3	1.92	2.18	2.13
4	1.93	2.01	2.10

Table 5.--Aggregation (Per cent aggregates greater than 0.21 mm. diameter) of Mhoon Clay Loam.

Rotation	1959	1960	1961
1	31.9%	27.6%	26.1%
2	33.9	29.0	28.5
3	38.8	33.2	30.3
4	36.2	33.6	30.3

The important findings that have resulted so far from this study are:

(1) In rotations where sod crops were grown or where cane trash was chopped and turned under, organic matter content and soil aggregation were higher than in the rotations where sod crops were not grown or cane trash was burned.

(2) In the rotation where sugar cane followed a legume-grass sod, sugar cane yields were higher than in other rotations, although part of this yield increase was offset by a slightly lower sucrose content.

(3) The standard rotation in which soybeans were grown during the year that the land was out of sugar cane resulted in a higher yield than the rotation in which the land was summer fallowed.

Definite conclusions from a study of this type are likely to be obtained only after a number of years of following the same rotations. This experiment is being continued and will run through another seven year rotation.

Physical and Chemical Properties of the Mississippi Terrace Soils along Bayou Teche

Because of the importance of the soil physical properties in determining the suitability of a soil for sugar cane production, an investigation was made in which the chemical and physical properties of certain important sugar cane soils were studied in detail. This study was made on the Mississippi Terrace soils in St. Mary parish. The soil survey of St. Mary parish prepared by S. A. Lytle and his associates was used in selecting the sites for study. Three representative soil series were studied: The Cypremort, Baldwin and Iberia series. These soils are alluvial in nature and were deposited from the overflowing of the Mississippi River when it occupied the channel now occupied

by Bayou Teche. The Mississippi River abandoned this channel about 2000 years ago and the soils on the natural levees have been developing since that time without the addition of more alluvium. Twenty-five representative samples of the surface soil of each of these three series were collected and analyzed for various chemical and physical properties.

The results of these analyses are shown in Figures 1 and 2. The data show that the better drained Cypremort soils, which occur at the highest elevation and closest to the stream channel, had the coarsest texture, the lowest organic matter content, the lowest aggregation, and the lowest levels of available nutrients. The low lying Iberia soils, which generally occur farthest from the main channel, were highest in clay content, organic matter content, aggregation and available nutrients. Irrespective of the high values for organic matter and available nutrients for the Iberia series and the low values of organic matter and nutrients for the Cypremort series, the Iberia is the least productive of the three series studied and the Cypremort is the most productive. The low position and poor internal drainage caused by high clay content result in the Iberia soils usually producing lower cane yields than the Cypremort soils. The Baldwin soils were intermediate in physical and chemical properties and productivity between the Cypremort and the Iberia soils except for available potassium content, which was highest in the Baldwin soils.

A study was also made of the dependence of soil aggregation on other soil properties. It was found that soil aggregation was largely determined by both the organic matter content and the clay content. Organic matter and clay were about equal in their effect on aggregation. The higher the contents of organic matter and clay the higher was the aggregation.

This study provides basic data on the physical and chemical properties of these soils which should be of value in determining the suitability of these soils for both agricultural and non-agricultural uses.

Figure 1.--Certain physical and chemical properties of the Cypremort, Baldwin and Iberia soil series.

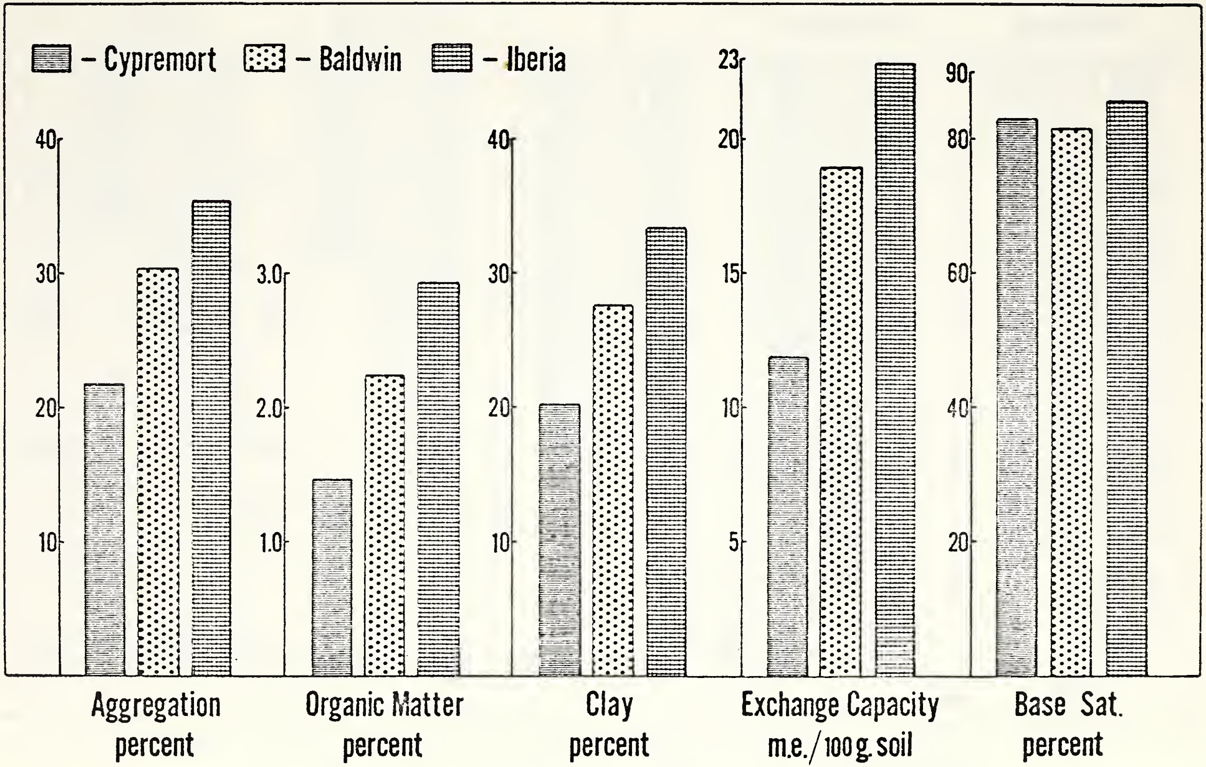
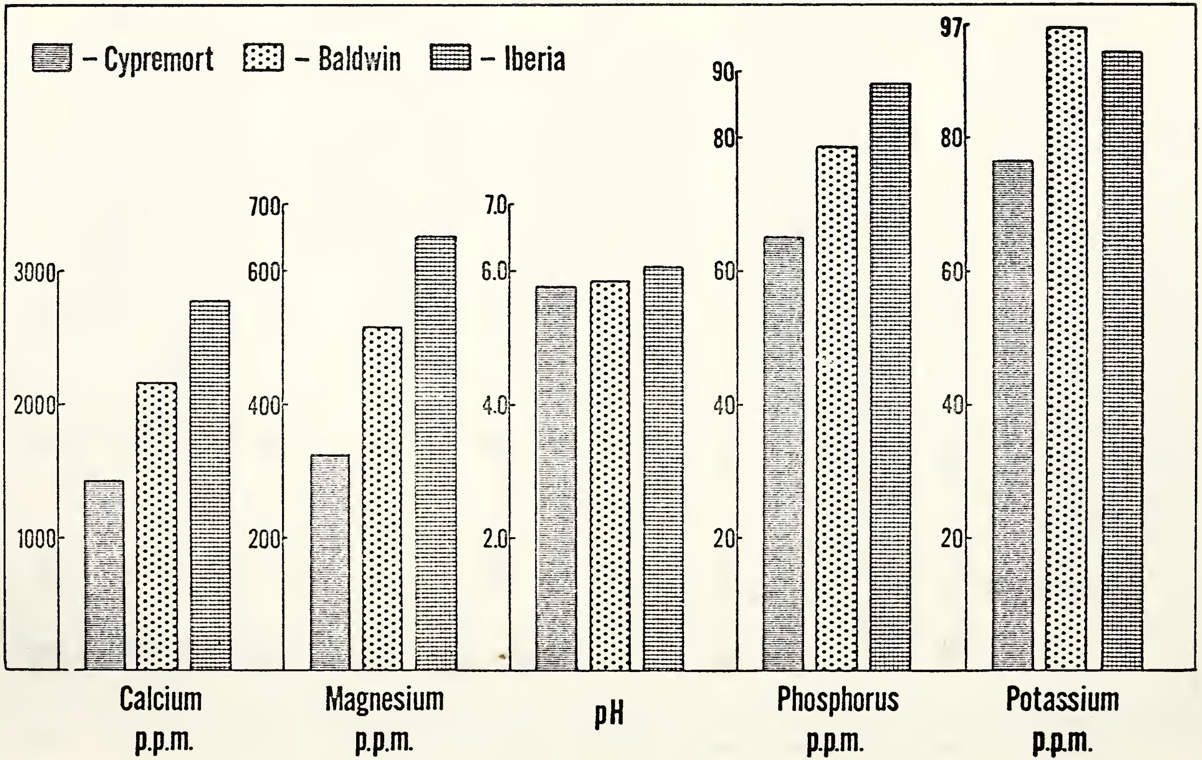


Figure 2.--Available nutrients and pH of the Cypremort, Baldwin and Iberia soil series.



CULTURAL PRACTICES IN SUGARCANE

By
Leo P. Hebert, Research Agronomist, Crops Research Division,
Agricultural Research Service, U. S. Department of Agriculture

Obtaining the maximum yield of sugarcane depends on many factors. Weather, soil, varieties, fertilizers, cultural practices, insects and diseases, all affect the outcome of the crop.

This paper presents the results of experiments on cultural practices which have been conducted at the Houma station for several years, and their application by sugarcane growers.

Shaving

The question of shaving sugarcane is controversial. Many growers contend that shaving is necessary to remove excess dirt from the seed piece. Others assert that the primary shoots must be removed to stimulate suckering or tillering for maximum yield. Still another claim for shaving is the need to remove weeds and to clean the surface of the row to facilitate application of herbicides.

The subject has been studied in a number of experiments at Houma and 2 recent publications summarized results of some of the trials (4, 7). Briefly, the conclusions reached are as follows: (1) It is not necessary to shave summer plant cane even if the advanced growth has been killed back. The dead portion of plant need not be removed to permit germination of lower "eyes" or buds, and in fact may protect them by insulating them from cold (2) Stubble need not be shaved. If the cane has not germinated, stubble diggers can be used to remove dirt and if it has germinated, shaving would only sacrifice some growth (3) Fall plant cane may fail to germinate if covered with too much dirt. This may be removed with a shaver in a scraping operation, or it may be removed with rotary hoes

available for that purpose. Heavy winter weed growth that cannot be eradicated with chemicals must be removed with a shaver or with mechanical hoes.

Off-barring

The row is off-barred in early spring to destroy some weeds and to prepare the row for application of fertilizer. Turning plows or disc cultivators are used for that purpose. Results of studies showed that it is not necessary to leave the row on the off-bar furrow as was formerly done (8) but that the row can be rebuilt immediately. Treatments in which the modified method of off-barring with disc cultivators was used and the row was immediately rebuilt, did not differ in yield from those off-barred in the conventional manner with turning plows. Rebuilding the row immediately improves drainage and leaves it in better physical condition for the application of anhydrous or aqua ammonia.

Dirting and Cultivating

Growers are not in agreement in regard to the time of dirting young cane in the spring. Noble varieties formerly grown in Louisiana were slow in tillering and could not be dirted until a good stand was established. Varieties now grown tiller much earlier in the spring and can be dirted sooner without important effect on yields. Studies have shown that, although early heavy dirting materially reduced the number of shoots or tillers in the spring, especially in early suckering varieties such as C. P. 36-105, yields of cane per acre were not greatly affected (6). Yields of cane per acre and of sugar per ton were not significantly different when an early-tillering variety, C. P. 36-105, a late-tillering one, C. P. 48-103, and an intermediate one, C. P. 44-101, were dirted to cover all tillers less than 6 inches tall

early in April than when the same 3 varieties were dirted back in April.

Organic Matter

The need for replenishing the organic material in the soil is well known and cannot be over emphasized. The manner in which this is done may result in a net disadvantage when fields are infested with johnsongrass and soybeans are grown as a green manure crop. This weed pest multiplies rapidly, especially in a field of soybeans where it has very little competition for light and receives nitrogen from the legume crop. Results of long-time studies show that yields of cane can be maintained either by (1) turning under soybeans, (2) turning under cane trash (leaves, tops, roots), or (3) adding nitrogen (5).

Cane farmers can take advantage of the fallow year to eradicate johnsongrass by repeated plowings and supplementing the loss of soybeans with additional nitrogen fertilizer and turning under cane trash.

Planting

Time

Hybrid varieties presently grown in Louisiana survive the winter much better than the noble varieties (*Saccharum officinarum*) formerly grown. The wild parents (*S. spontaneum*) impart a certain degree of cold tolerance to the progenies. Cane planted in August usually establishes a good root system before winter and is able to survive the winter (9). In some years when an early freeze occurs there is danger of stand losses if the cane is killed after the seed piece has been exhausted of its food reserve and before it has established a good root system. Since the date of the first freeze cannot be predicted a portion of the acreage should be planted in August to use the labor supply more efficiently and to take advantage of the better germination and increased yield that

can usually be expected from cane planted in August.

Varieties

Each soil type and area of the state differs in available nutrient, physical properties and to some extent in environment. Variety recommendations are made for specific areas and soil types (1). Some varieties respond better to early plantings than others. It is not the purpose of this report to make specific recommendations for each area, but it can be said in general that N. Co. 310 should not be grown where mosaic is prevalent (2). Some early-maturing varieties should be grown for early harvest. C. P. 48-103 and C. P. 47-193 are early-maturing varieties which could be grown for that purpose. C. P. 48-103 is not recommended for heavy or weed-infested soils because of its relatively low vigor. C. P. 47-193 is adapted to both light and heavy soils and is especially recommended for planting on heavy soil. C. P. 44-101 and C. P. 52-68 are adapted to light and heavy soils and perform well on both types but mature later than the other 2 varieties.

Seed bed

Sugarcane, a perennial crop, remains on the same bed for 2 or 3 years. It is important that this bed be in very good tilth for best results both with respect to seedcane germination and to control weeds. A poor stand in the plant cane is carried over into 2 stubble years and not only affects cane yield but also results in increased weed infestation. More time should be spent on preparing the seed bed to make conditions as favorable as possible for obtaining a good stand. A good seed bed is one that is free of large clods, coarse plant residues and weeds. Good drainage is essential for best results.

Seed piece size

Although very short seed pieces give a higher percentage of germination than the longer ones the young plants do not survive the winter as well and do not yield as much as the longer seed pieces. On the other hand whole stalks germinate slowly and in many cases the lower buds are completely suppressed. The best compromise is to plant 5- or 6-eye seed pieces or usually segmenting a 10 to 12-eye stalk into 2 pieces (3). Planting 2 continuous stalks plus a 10 percent overlap plants 36,000 to 40,000 buds per acre. Usually not more than 25 percent of the buds germinate, but 9,000 to 10,000 shoots per acre constitute a good stand.

Depth of Seed Placement

Deep placement of seed pieces is recommended for summer or early fall planting (9). Mechanical injury to the crop often results from shallow planting. The seed material should be placed approximately 2 inches above the furrow. For late October or November planting the seed cane should be placed 6 inches above the furrow. Shallow covering is recommended, especially in August and September. Good drainage is essential in all cases.

Depth of Covering

Many stand failures are due to excessive covering. The cane should be covered with only 2-3 inches of soil in the summer or early fall to insure rapid germination and emergence (9). When the cane begins to grow it should be dirted to control weeds and to protect it from cold. More covering is necessary for cane planted in the late fall when 4-6 inches of dirt should be used.

Literature Cited

1. Anonymous. 1961. 1961 Sugarcane variety recommendations for Louisiana. Sugar Bull. 39(23):286-289.
2. Abbott, E. V. 1960. Studies of the mosaic problem in Louisiana. Sugar Bull. 39(2):23-27.
3. Hebert, L. P. 1956. Effect of seed-piece size and rate of planting on yields of sugarcane, and nitrogen fertilization on yield of seed-cane in Louisiana. Internat. Soc. Sugar Cane Technol. Proc. 9:301-310.
4. Hebert, L. P. 1962. Effect of shaving C. P. 44-101 second stubble or yields of cane and sugar in 1961. Sugar Bull. 40(9):94-96.
5. Hebert, L. P. and Davidson, L. G. 1959. Effect of cane trash and legume crops with nitrogen on yields of cane and sugar, and on organic matter content of sugarcane soils in Louisiana. Internat. Soc. Sugar Cane Technol. Proc. 10:565-579.
6. Hebert, L. P. and R. J. Matherne. 1963. Effect of time of spring dirting on yields of sugarcane and sugar in Louisiana. Sugar Bull. 41(8):97-101.
7. Hebert, L. P. and R. J. Matherne. 1953. Results of tests conducted over a number of years to determine the effect of shaving sugarcane on yields. Internat. Soc. Sugarcane Technol. Proc. 8:253-260.
8. Hebert, L. P. and R. J. Matherne. 1957. Comparison of the usual off-barring with a modified method of off-barring on yields of sugarcane in Louisiana. Sugar Bull. 35(9):119-120, 123.
9. Hebert, L. P. and R. J. Matherne. 1959. Effect of depth of placement of seed piece and date of planting on yields of cane and sugar from C. P. 36-105 and C. P. 44-101 at Houma, La. Sugar Bull. 37(20):260-265.

SUMMARY OF SPECIAL CLARIFICATION TESTS IN USDA PILOT PLANT DURING 1960-62 CROPS

by

E. E. Coll, W. F. Guilbeau, B. A. Smith and J. T. Jackson
Southern Regional Research Laboratory[1]
New Orleans, Louisiana

INTRODUCTION

Special pilot plant clarification tests made during the last three Louisiana crops are summarized in this report. All clarifying agents investigated are commercially available products that have novel physical and chemical properties, or those reported to improve clarification in commercial practice. Results of the 1960-61 tests were reported earlier (1), (2), along with the results of parallel control tests. All controls were included in the standard cane variety processing tests described and reported in other publications (3), (4), (5).

Results with the following products are summarized in the report:

(1) Separan AP 30[2], a water soluble anionic resin product of the Dow Chemical Company.

(2) Panther Creek Bentonite[2], a calcium bentonite product of the American Colloid Company.

(3) Polyox[2], a water soluble nonionic resin product of Union Carbide Chemical Company.

1/ One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

2/ It is not the policy of the Department to recommend the products of one company over those of any others engaged in the same business

(4) Reten 205[2/], a water soluble cationic resin product of the Hercules Powder Company, Inc.

(5) UCAR C-149[2/], a water soluble cationic resin product of Union Carbide Chemical Company.

(6) Potato starch.

(7) Magnesium hydrate[2/], a product of the Michigan Chemical Corporation.

(8) Calcined magnesite (magnesia)[2/], a product of Basic, Inc.

(9) Sodium aluminate.

Separan AP 30 was tested extensively to determine optimum dosage rates for clarification. The summarized data in Table I do not show

Table I (1960-62 Crops)

No. of Tests	Separan, p.p.m. on Juice	Mud Weight[1/]	Percent of Control Clarified Juice Clarity	Percent of Control Clarified Juice Filterability
13	2.2	116	100	110
6	4.4	122	97	111
2	6.0	136	92	108

1/ High ratio represents low mud weight.

variations between individual tests, but are intended to represent the overall performance under various conditions of cane quality. The majority of tests were on juice from hand harvested cane samples that are not representative of commercial operations. Separan is most beneficial when processing cane of inferior quality, whether the quality deterrent be cane variety or maturity, soil in juice, trash, delay in milling, or the growing season. Mud weight and clarity of processed

juice decreased with each increase in Separan dosage. By limiting the Separan to 2 to 3 p.p.m. on cane, a 15 to 20 percent improvement in mud weight can be expected with very little sacrifice in clarity. Filterability of clarified juice was improved about 10 percent at all Separan levels. Additional work is planned for the 1963 crop to obtain more information in the 4 to 6 p.p.m. Separan range.

Six tests were to determine the value of bentonite added to mixed juice before liming, with Separan added at the flash tank to prevent an increase in mud volume. Results are summarized in Table II on commercial

Table II (1961-62 Crops)

No. of Tests	Bentonite Lbs./Ton Cane	Separan p.p.m. on Juice	Percent of Control			
			Mud Weight[1/]	Clarified Juice		Clarification Efficiency
				Clarity	Filterability	
Hand Harvested Cane:						
2	0.4	3.8	166	101	114	103
1	0.6	2.1	94	114	167	117
Commercial Cane:						
2	0.4	3.2	109	103	82	104
1	0.6	2.2	103	107	132	111

[1/] High ratio represents low mud weight.

and hand harvested cane samples. Two levels of bentonite treatment were used, with the higher levels of Separan corresponding to the lower bentonite rates. Processed juice quality was improved over controls with respect to clarity, filterability and clarification efficiency, with no appreciable change in mud volume, while using 0.6 pounds bentonite per ton cane and 2.2 p.p.m. Separan. With 0.4 pounds bentonite and

3.5 p.p.m. Separan, the results were quite different. Mud volume improved 9 percent on commercial and 66 percent on hand harvested samples. Processed juice improvement was slightly better on the hand harvested samples, but was inferior to that obtained with 0.6 pounds bentonite per ton cane for both commercial and hand harvested canes. No further work is planned with bentonite until clean, unburned fresh cane becomes available for processing.

Results of the remaining 13 exploratory tests are summarized in Table III. The water soluble flocculating agents Polyox (nonionic),

Table III (1961-62 Crops)

No. of Tests	Additive, p.p.m. on Juice	Percent of Control: Mud Weight[1/]	Clarified Juice: Clarity	Clarified Juice: Filterability	Clarification Efficiency
<u>Polyox</u>:					
3	3.5	96	109	72	109
<u>Reten 205</u>:					
3	3.1	85	100	118	104
<u>UCAR C-149</u>:					
2	4.3	100	100	108	100
<u>Potato Starch</u>:					
2	60	90	100	105	100
<u>Magnesium hydrate (Substitute for hydrated lime)</u>:					
1	-	130	69	42	60
<u>Magnesia - Lime (38% magnesia - 62% hydrated lime)</u>:					
2	-	97	89	85	89
<u>Sodium aluminate[2/] - lime - Separan</u>:					
1	2.3[3/]	136	67	47	57

1/ High ratio represents low mud weight.

2/ 0.33 pounds per ton cane added continuously to liming tank feed.

3/ Separan.

Reten 205 (cationic), and UCAR C-149 (cationic) have ionic characteristics that may be expected to improve clarification to a greater degree than Separan AP 30, which is nonionic in acidic and neutral solutions and anionic in alkaline solutions, since the colloids in cane juice are principally negatively charged. The flocculating agents were added to the process as recommended by the manufacturer, i.e., continuously to the flash tank in a 0.05 percent water solution (like Separan). Test results were neutral to negative for all three flocculants.

The results of one test on potato starch addition to the flash tank were negative. An increase of 10 percent in mud volume was obtained with no improvement in processed juice quality. Sixty p.p.m. starch on cane was added in a 1 percent solution.

Magnesia was substituted for lime at two levels, i.e., 100 percent and 38 percent of the CaO requirement. Michigan Chemicals Company furnished magnesium hydrate for the 100 percent substitution, and calcined magnesite from Basic, Inc., was the source material in two 38 percent substitutions. Poor clarification was obtained with complete substitution. Juice quality factors averaged only 60 percent of control, although there was a 30 percent improvement in mud volume. Mud improvement was partially due to 6 percent of the total insoluble solids remaining in the clarified juice. Juice quality was only 10 or 15 percent below controls, with no mud quantity improvement, on the 38 percent substitution tests. In the later tests Mg/Ca ratios in clarified

juice were 0.50 and 0.75 for controls and tests respectively, with identical totals of Mg plus Ca. The substitution of a small amount of magnesia for lime, about 20 percent, may help alleviate the evaporator scaling problem without lowering the clarification efficiency appreciably. A good flocculating agent may also improve the juice clarity.

Results were unsatisfactory on one test with standard liming following the continuous addition of sodium aliminate at the rate of 0.33 pounds per ton cane. Juice quality and mud values paralleled closely those obtained by 100 percent substitution of magnesia for lime.

ACKNOWLEDGMENT

The work was made possible through the continued support and cooperation of Louisiana sugarcane growers and processors, and members of the following organizations: The American Sugarcane League, Audubon Sugar Factory of Louisiana State University, Southdown, Inc., St. James Sugar Coop., and St. Gabriel Plantation. Mr. Lloyd Louden of the League and personnel of St. Gabriel Plantation deserve special thanks for their efforts in cultivation and harvesting of the cane samples furnished by the League.

REFERENCES

(1) Coll, E. E., Jackson, J. T., and Guilbeau, W. F., Sugar Bull. 39(24): 298-303 (Sept. 15, 1961).

(2) Coll, E. E., Guilbeau, W. F., Fort, C. A., and Jackson, J. T., Sugar Bull. 41(9): 110-115 (Feb. 1, 1963).

(3) Guilbeau, W. F., and Martin, L. F., Sugar J. 16(1): 12, 14-15 (June 1953).

(4) Guilbeau, W. F., Coll, E. E., Fort, C. A., and Jackson, J. T., Sugar Bull. 39(16): 186-191 (May 15, 1961).

(5) Coll, E. E., Guilbeau, W. F., Fort, C. A., and Jackson, J. T., Sugar Bull. 40(17): 181-185 (June 1, 1962).

EXPERIENCES WITH THE CRUSHER

L. A. Suarez
Glenwood Sugar Factory
Napoleonville, Louisiana

First of all I must say that our experiences might not hold good for other factories or even help us from year to year, because of the remarkable variations in mud, trash, type of cane, fiber, etc. However, it was decided to write about these experiences, hoping that in some way it could be useful to others.

About five years ago the crusher at Glenwood was completely overhauled. All the journals were metalized with stainless steel. New Stainless steel housing wearing plates, all new bearings, with the top bearing bolted together in one place were installed. This complete job was done at Nadler's Foundry, including the metallizing.

We were using three inch pitch grooving. The pitch was not changed, but the angle was reduced from 60° to 40°.

After this overhauling we experienced that the pressure on the crusher had to be reduced to between 120 and 150 tons to make the top roll float. Under this condition and with typical variations of trash and mud, etc., the crusher at times would lift too much, almost emptying the cane in the chute and immediately the man feeding the cane, would increase the feed, choking Mill No. 1. This would happen more readily with constant pressure accumulators.

Because of this situation, pressure was increased on the crusher so that it would not float. The opening on the crusher was increased and we always had enough cane in the chute to assure extraction.

The past crop hydraulic equipment was bought from Edward Engineering Corp. to automatically control the speed of the cane carrier and the feed to the crusher.

Under this new conditions the pressure of the crusher was lowered so that the top roller would move. The pressure was kept at around 150 tons and although at times it would float more than 3/4", due to a continuous regulated feed of cane, it would drop down and never choke Mill No. 1.

At first we were operating at 43'/min. and at that speed we were getting a great deal of slippage, although the pressure had been lowered. After several changes we decided to open the crusher and reduce the speed to 30'/min. and at this point operation was satisfactory.

In short, I will like to say that with different cane preparations, speed opening and pressure have to be varied. No doubt there would be a point where the operation of the crusher would be more satisfactory, and if at this point we also have automatic feeding, we would not experience difficulties with overfeeding of the mills as a result of poor judgement by the man feeding the crusher.

Mill Setting at Glenwood

Crusher	42.0	Cubic ft/min when floating 3/8"
Mill #1	30.00	Cubic ft/min when floating 3/8"
Mill #2	25.00	Cubic ft/min when floating 3/8"
Mill #3	20.00	Cubic ft/min when floating 3/8"
Mill #4	16.00	Cubic ft/min when floating 3/8"
Mill #5	14.5	Cubic ft/min when floating 3/8"

SUMMARY OF REMARKS TO BE MADE AT THE AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

W. D. Carpenter
Monsanto Chemical Company
St. Louis, Missouri

I would like to spend my time telling you of how we go about finding new herbicides - weed killers for sugar cane. I know that as you see your fields covered with Johnson grass, you wonder what in the world the chemical companies are waiting on. You've got a problem; you're willing to pay for a solution; and the problem is big enough that this represents a large market.

Well, we are aware of your problem. We are very anxious to solve it for you, and we are devoting large amounts of time and money to solving it, and hope we are closer than we were.

When you see a weed killer for Johnson grass or other weeds on your sugar cane, you are looking at the end result of many years of work by a large group of people. These people represent the chemical companies such as Monsanto who initiate the work, the Experiment Station workers of the U.S.D.A. and Louisiana State University such as Dr. Stamper and Dr. Millhollon, and finally people such as you who are the end users. At any place along the way the chemical could prove to be unsuccessful for any number of reasons. In fact, we would come up with the perfect herbicide for sugar cane with recommendations by Dr. Stamper and Dr. Millhollon and it won't be a bit better than the way it is applied by the man who actually puts it on in the field.

I thought you would be interested in hearing how a new herbicide is developed for use in sugar cane from the time it comes from some chemist's mind to the application of the first pound to go on sugar cane.

Monsanto has many areas in which chemical research is going on - plastics, synthetic fibers, foods, detergents and agriculture. Our chemists

are constantly preparing new compounds for all of these different uses. Every one of these compounds go to our Agricultural Research Center where it is evaluated for possible use in agriculture. Thousands of these newly invented compounds go there every year. Each one is looked at to see if it has possibilities not only as a herbicide, but also as an insecticide, fungicide, defoliant, animal feed additive or in any way where chemistry can aid agriculture.

The story of the herbicide, then, is the same for the other agricultural chemicals.

When a chemical comes in to our Agricultural Chemical Laboratories, it is assigned a code number and this number is used until the material becomes commercial. With some of these chemical names being as long as they are, it is easier to remember a number.

We take a large number of important weeds and crop seeds from all over the United States - field bindweed from the West, wild oats from the Northwest, giant foxtail from the Mid-West, morning glory and smartweed from the East. From the South we have Johnson grass, nut grass and crab grass. Crops are also planted. Then these pans are sprayed with several rates of each chemical. Each crop and weed specie are watched for several weeks to see what plants were killed, stunted, delayed, sprouting, and at what rates this happened. This is done for pre-emergence (seeds) and for the established post-emergence plants. We set very high standards in these tests, because we know it is easier to control weeds in a greenhouse than under field conditions. As a result, most of our chemicals never get by the first test. If they look promising, they are put through more greenhouse tests at lower rates against different crops and weeds and for longer periods of time. (I then will discuss controlled climate rooms.) By now, it is over a year from the time the chemical left the chemist's bench and was delivered to the biologist. Perhaps one out of a thousand survive

these tests. If it still continues to look good, we then go to the field on our experimental farm and to a few selected universities and experiment stations across the United States for limited field studies on a variety of crops. Once again, this is done at several rates both pre- and post-emergence to both crops and weeds. Once again, most of the compounds bite the dust, and perhaps two or three survive to carry over into the third year.

Let us say that one of the chemicals looks good in the field on sugar cane the second year. The third year the chemical is sent to more places - Louisiana, Hawaii, Florida, Puerto Rico, etc., and on larger field tests. If the results continue to be satisfactory, arrangements are made to obtain samples of the crop in order that our chemist can determine if the product carries over into the raw sugar, or the molasses, or the bagasse. While this is going on, our chemist would be making radioactive derivatives of the herbicide in order that our biochemist can follow the chemical when it is placed in the soil or on the plants both cane and weeds. We determine whether it is leached away by rain, does sunlight break it down, do the soil organisms break it down? Methods are devised to test for the presence of the herbicide in very small amounts in all parts of the cane and the end products of cane.

Somewhere about this time extensive studies are started to determine the fate of the compound when fed to animals over long periods of time. Usually this will be done for several animals, such as rats, rabbits, dogs, etc., and for a wide range of rates of chemical feed for periods up to two years. Sometimes it is done for more than one generation. Weight gains, appetite, appearance - all of these factors are considered. The effects on the skin of the animals are studied; what happens when the material is accidently swallowed or is spilled in the eyes is investigated.

Also, the studies of formulation of the herbicide have begun. Should it be an emulsifiable concentrate, should it be a wettable powder, or granules? Does the activity or toxicity change when we change the formulation? How does it survive storage tests, freezing, heat and long shelf life? What effect does it have on the equipment; is it abrasive or corrosive?

By now, our engineers and chemists have begun to study how to make this material. What type of plant needs to be built, where should it be built, and how big should the plant be to meet the needs?

The Sales people must start planning on how to market this material. What sort of advertising, what sort of literature do we need, what size of containers, where will we sell first?

The Research and Development people accumulate the information to present to the U.S.D.A. and F.D.A. to show the effectiveness, safety and procedures of analysis of the new herbicide, and approval is obtained from the Federal Agencies and recommendations from the various herbicide authorities such as Drs. Stamper and Millhollon.

A label has to be approved which shows the safety, precaution, contents and directions for use. These will have been worked out with Drs. Stamper, Millhollon and you during the years we have been testing as to rates, volumes, timing, method applications, weeds controlled, etc.

And the next year a new product will be on the market.

This procedure generally takes 4 to 7 years at a cost of 1/2 to 1 million dollars for most herbicides with the combined efforts of us, the University, and Experiment Station workers and progressive sugar cane planters such as you. With all of this hard work, the chemical will work no better than the manner in which it is used.

THE STORAGE OF SUGARCANE POLLEN

J. R. King
Department of Horticulture and Landscape Architect
Louisiana State University
Baton Rouge, Louisiana

AN ABSTRACT

The extension for many months of the germinability of sugarcane pollen would be of particular value in the breeding of sugarcane by making possible the long-distance shipment of viable pollen among cane breeding projects throughout the world and by the storage from season to season of the germ-plasm of desirable late blooming selections. A new approach to the problem of cane pollen storage is now being made by the freeze-drying method. Encouraging results are reported in the production of seedlings from pollinations made at the Northern Sugar Experiment Station, Gordonvale, Queensland, Australia, with freeze-dried cane pollen processed four months earlier at Louisiana State University. The experiments are being continued during 1963 and 1964.

PRODUCING SUGAR CANE IN LOUISIANA WITHOUT PUTTING IT ON THE OFF-BAR

S. J. Rodrigue
Gold Mine Plantation, Inc.
Edgard, Louisiana

So that you can realize the results that we are getting with this practice of producing cane without putting it on off-bar -- I will give you a short history of the Gold Mine Plantation where I have been carrying out this and other practices to help obtain the yields we get.

All of the land on this plantation has been in sugar cane production for the last 60 years or more in a crop rotation of cane, corn and peas; or soybeans and peas or soybeans. During the past 13 years, we have brought in a livestock program and changed this rotation to where we put about 5 percent of out land in pasture for about three years and hog-off about 25 acres of corn each year before it goes into sugar cane. The rest of the land still has a rotation of cane three years, then corn and soybeans, soybeans, clover for one year.

Our livestock consists of 24 brood sows, 350 market hogs a year, 400 ewes, 200 lambs, 40 brood cows and 25 yearling steers and heifers.

We have a total land area of 890 acres, with measured crop land of 700 acres, of which 40 acres is heavy soil and the balance sandy to light mixed.

Prior to 1940, we grew 500 acres more or less of cane and 200 acres of corn and peas or soybeans, producing 13 tons of sugar cane per acre and 15 bushels of corn per acre. Before 1950 we had a full infestation of Johnson grass and, because of the need of corn for mule and hog feed, we had very little land that we could fallow plow. Therefore, we did not make much progress in Johnson grass control under the fallow plowing program and soon gave it up.

We have had our best grass control with our livestock, particularly the sheep, with the help of chemicals. We also have improved our drainage with land crowning and good ditches.

Having to produce corn along with sugar cane -- and in those days of poor production we had a very limited working power -- we were at a loss as to what work to do first in the spring. We knew that if we delayed in off-barring, dirting the cane, and applying fertilizer, the cane crop would suffer. And by the same token, if we delayed in our land preparation for corn, our corn crop would fail. Every year we were faced with the same problem, and never found a better solution.

While reading Extension Circular Number 151, titled "Sugar Cane Production for South Louisiana", I got the idea for the method of cultivation which we are now doing. From this circular, under the title of "Cultivation", I quote:

"But the off-bar furrow should not be run until the cane has clearly shown that it is approaching the stage when we can expect it to come to a stand. This is particularly true in the case of stubble cane and it is true because the off-bar furrow has to prune the greatest portion of the old root system. Experiments have shown conclusively that this old root system functions in feeding the young cane until it has established its own root system and for that reason, as much of it as is possible should be left intact as late in the season as is practicable." End quote.

With this information I felt I was right in trying off-barring and dirting back in the same operation without using stubble diggers and hoeing. In 1948 we tried this on a small acreage with a double chopper. Results were good so we gradually increased use of this method on additional acreage every year. By 1952 we were cultivating our entire crop in this

manner. This method was a big help in the early spring, as it gave us a chance to get our corn land ready without delaying the cane work.

In 1955 I designed an implement to apply the fertilizer in the same operation. This implement consists of two light subsoiler shanks 26 inches apart mounted on a tool bar to apply the anhydrous ammonia. The ammonia is released on both sides of the subsoiler point, which places the ammonia 12 to 14 inches below the top of the row. I also release a small amount of ammonia six to eight inches below the top of the row against the stubble, for early growth. On the same tool bar to which the subsoilers are mounted, I have a conventional dry fertilizer box, which is ground driven, to apply potash. The potash is placed 6 to 12 inches deep in each side of the row in the subsoiler opening. I installed two 26 inch notched coulters in front of the subsoilers to cut the cane roots so that the subsoilers would not pull up the stubble and would not leave too large an opening on each side of the stubble. Thirty inch coulters would have been better, but they are not available at present. On a tool bar 19 inches back of the front one, I have one cultivator disc gang for each side of the row to bring the soil back to the stubble. Two gauge wheels, which also act as press wheels, seal the ammonia in the soil.

In this one operation we broke the soil 12 to 14 inches deep on each side of the row, applied anhydrous ammonia at two levels and in six areas, applied a dry fertilizer at two levels, put the row back up, and pressed the soil on each side of the row. We have done that without putting the cane on the off-bar furrow and have waited to do it until after the cane was up. Out plant cane is off-barred and dirted back in one operation with a double chopper to which we have the conventional ammonia applicators attached, with a conventional dry fertilizer box

mounted on the chopper frame to apply the fertilizer in this one operation.

I have used this method on our entire crop for the last five years and have averaged above 30 tons each year, 37 tons for the '62 crop, without the varieties of N. Co. 310, C. P. 52-68 and with only 20 acres of C. P. 44-101. During that five year period we have maintained one third of our cane acreage in plant cane, one third in 1st year stubble, and one third in second stubble.

The plant cane was planted at the end of September and in early October following a corn crop.

Besides the number of trips around the field this method of cultivation eliminated, I find it is a big help in grass control because the same soil that was on top in the middles during the plant cane year is still more or less on top during the stubble crops. We clean it during the plant cane year so there are less seeds to germinate during the stubble crops. Also, we do not burn the trash left in the middles from the harvested crop. That helps build the organic matter in our soils.

We use 175 units of nitrogen in our second year stubble and 150 units in the first year stubble. This gives the cane lots of growth and therefore when we harvest we have to top very low to get a standard sucrose. Because of this high rate of fertilizer, we left 15 percent of the harvested crop in the field last year by topping low. But we still averaged 37 tons per acre.

Some of the advantages of this high rate of fertilizer application are:

1) High tonnage of organic matter put in the soil to improve it.
2) Delivery of clean cane to the mill, that is cut and burned the same day because all the green leaves are cut off. Because the cane is tall, heavy and grew fast there is very little grass in the middles.

3) With all this extra growth, we have better protection from an average Louisiana freeze.

4) The fertilizer is applied deep so that the cane gets it instead of the grass and, being as the cane is growing rapidly it soon shades out the grass.

We are controlling the Johnson grass on our ditches by mowing until September and following the mowing with grazing by sheep.

We use for seed only plant cane that has been rogued for Mosaic and heat-treated for Ratoon Stunting Disease (RSD). We have made yields of 45 tons with second stubble on land where we followed the livestock and pasture rotation and believe that in the near future we can average 50 tons per acre.

May I suggest that anyone trying this method of cultivation with the subsoilers do it on a small acreage, especially in the heavy soils because of the danger of the subsoiler leaving a hollow in the ground on the sides of the stubble. It is better to leave the row of stubble as is than to chop it before coming in with the fertilizer applicators. The ammonia will stay in better in firm soil.

I thank you.

NON-METALLIC MILL BEARINGS

William S. Patout
M. A. Patout & Sons, Ltd.
Jeanerette, Louisiana

In April of 1961, while employed at Olokele Sugar Co., I started correspondence with the Gakte Corporation, exploring the possibility of installing a nonmetallic Gatke "Hydrotex" water lubricated bearing liner on the off side of the discharge roll of No. 4 mill. It was my thinking at the time, that because the "Hydrotex" material developed by the Gatke Corporation is water lubricated, it might be possible to get away from the inherent lubricating problems of most automatic or drip type oil systems and thus use only a spray of water on the roll journal as the only lubricant. I was later advised by the engineering staff of Gatke Corporation that their material is primarily a heat insulator with a thermal conductivity of .17 BTU per hour SQFT/^{o}F/Ft. This is less than the conductivity of water, which is approximately .39, and it is 200 times less than the conductivity of most bearing metals such as brass, bronze and babbitt. Because of its insulating characteristics all frictional heat built up in the bearing must be removed at the journal surface as rapidly as it develops, as the maximum temperature at which the bearing can operate over a prolonged period before deterioration (carbonization) starts is 300 degrees F. It was further recommended that as the speed (feet per minute) of a mill roll journal is too slow to provide adequate film lubrication with water alone, it would be necessary to use some lubricant which would be introduced directly onto the journal.

During the month of September 1961, it was decided to go ahead with the installation using a liner that was designed for only 148^{o} arc. The

existing brass liners were a full 180 degrees. This was made necessary because the design of the housing limited the space available for installing the spray headers and also it allowed a greater journal surface area for the water (coolant) to come in contact with bearing. The liner upon arrival was put into a solid cast iron quarter-box and held in place by two bolted steel keeper stips. A chamfered oil groove of V shape was not used in the liner (non-metallic) as the oil was dripped onto the exposed portion of the journal. One 3/8" water line was installed directly over the journal with six Oliver filter misting jets. The top edge of the liner was slightly lowered so that the water would drain away from the mill and into a receiving pan. The amount of water being sprayed onto the journal was reduced until it was found that 1.50 gpm were sufficient for dissipating the heat. It is interesting to note that the brass bearings on the feed and discharge rolls were using between 4 to 7 gpm for cooling.

It is felt at this that there might be a possibility that the liner could be operated with water being the coolant and only lubricant. Plans have been made for a test at the start of the 1963 crop.

In conclusion, I will say that we have been completely satisfied with the performance of the liner, which has now been in operation for 3,585 hrs. During this time the tandem has ground or crushed 389,300 tons of net cane. I feel that the non-metallic Gatke "Hydrotex" liner is superior to the standard brass liner because of the following reasons:

1. The liner can be supplied ready for installation for less than one-half the cost of an equivalent brass liner.
2. The liner has all surfaces moulded, thus clearance and tolerance are not as critical as when using a metal liner.

3. The liner can be changed or replaced in far less time than a brass liner, because of its light weight (20%) and as the chair (quarter-box) is a solid casting, the precautions and steps necessary to prevent water from leaking from the jackets are eliminated.
4. The liner being a resin-bonded fabric inherently neither harms or is harmed by metal. In other words, should the coolant or lubricant fail, galling and scoring of the shaft will not result. As was proved to us on several occasions, if the coolant should fail, the liner gives off a distinctive odor at excessive temperature and thereby gives a warning, before serious damage can occur.
5. The liner, unlike metal, has a degree of resilience under excessive pressure which allows conformity to minute variations of the shaft. This slight tendency to flow under extreme pressure allows the bearing or liner to be somewhat self-aligning and allows it to absorb shocks and blows without taking a permanent set.
6. The liner requires less coolant than brass.

Some points to consider when designing and installing a non-metallic Gatke "Hydrotex" liner as a replacement for a brass liner.

1. The maximum temperature at which the liner can be operated is 300°F. If this temperature is sustained at the liner surface for several hours or more and not merely intermittent, some carbonization will begin to take place. Even if the liner does deteriorate, the metal journal will not be affected.
2. The material has an ultimate compressive strength of approximately 43,000 p.s.i. While this type of material does not have definite yield joint, such as is characteristic of metals, nevertheless, there is a portion of the stress-strain curve that might be characterized

as yield portion, and this occurs at approximately 23,000 p.s.i. In this consideration the total thickness of the liner must also be taken into account because the material has an elastic modulus of only 1,000,000 and under high loading, a thicker liner will have greater deformation than a thinner one. Sometime this deformation is mistaken for yield although it is still within the elastic range. Therefore, the thickness of the liner should be no more than what is economically required for adequate wear life. In other words it should be established just how much wear can occur in the liner before replacement has to be made and then the thickness should be established on that basis.

3. The basic composition of the liner involves woven cloth using cotton synthetic and asbestos fibers and then saturated with a phenolic laminating resin and molded under heat and pressure (approximately 4,000 p.s.i.) to the required shape. This material can be readily cut with a saw, ground (filed) and drilled by hand.

GENERAL PROPERTIES OF GATKE BEARING MATERIAL

Physical characteristics of major interest are:

Tensile Strength	11,000 to 13,000 p.s.i.
Compressive Strength	
Flat	40,000 to 43,000 p.s.i.
Edgegrain	24,000 to 26,000 p.s.i.
Flexural Strength	20,000 to 22,000 p.s.i.
Shear Strength	10,000 to 11,000 p.s.i.
Impact Strength (Charpy)	12 ft. lbs. per inch
Hardness (Rockwell "M")	105
(Scleroscope)	85 to 95
Expansion Coefficient	.00005 per Degree F.

Moisture Absorption (Immersed)	1 to 2%
Dielectric - Short time	50 to 400 bolts per mill
Step by Step	30 to 285 per mill

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 11 - Papers for 1964

December 1964

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 11 - Papers for 1964

December 1964

FOREWARD

This is the eleventh volume of proceedings of the Society which has been published since its founding in 1938.

The first volume published in 1941 included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume published in 1946 included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer edited that edition.

The third volume published in 1953 included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years of 1950 through 1953. Volume five contains papers for the years of 1954 and 1955. The sixth volumes were edited by Dr. Arthur G. Keller.

The seventh volume, which is in two parts. 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth, ninth, and tenth volumes contain papers presented during 1961, 1962, and 1963 respectively. These volumes, as well as this, the eleventh volume, which includes papers for the year 1964, have been compiled by the writer.

Denver T. Loupe
Denver T. Loupe
Secretary-Treasurer

December, 1964

INDEX

General

THE 1963 HARVEST AND MECHANICAL IMPROVEMENTS FOR 1964

L. L. Lampo
J. & L. Engineering Co., Inc.

The 1963 harvest season has, we hope formally committed us to a declaration of war to conquer the varied problems that are presented when our industry is faced with down cane.

Down cane has been given many names, recumbent, flat, sprawled, lodged and many others that a good Sunday school teacher dare not use. But regardless of name the results on the efficiency of mechanical harvesters are much the same. Operating speeds are reduced by as much as 60%, accurate topping becomes difficult, up-rooting under certain conditions gives our factory friends headaches with additional mud that clings to roots. Yet, barring a heavy or early freeze we get the crop to the mill and kept the figures well into the black.

Foresight of the Machinery Committee and Staff of the American Sugar Cane League: Should any growers or mill operators here today have a shadow of doubt as to the performance of the American Sugar Cane League and its committees the following statement may clear the air for many years beyond the 1963 crop.

In late September our president, Joe Pugh received a telephone call from Mr. Roland Toups who, at that moment was attending a special Machinery Advisory Committee meeting. The conversation as I recall went something like this "Joe, we've completed a survey of equipment in the hands of growers, the size and weight of this crop has us worried, do you think you people could gamble with us on squeezing out another ten or more harvesters as a safety. Wind or rain in any amount could lower the boom on this crop."

As a result of such foresightedness and assistances from Gilbert

Durbin, Lloyd Lauden, Senators Allen Ellander, Russell Long, Congressmen Ed Willis, Jimmy Morrison and Gillis Long, keeping pressure on our suppliers our company was able to deliver twenty-four (24) new harvesters, and seven reonditioned machines into the fields for service during the 1963 harvest season plus the release of our four demonstrators to farmers who were short of harvesting equipment.

<u>The Penalty Paid for During Harvest Production</u>: Though we gloat over production performance we paid an anticipated penalty by over-loading our service personnel from the heavy demands placed on them by the crop and weather conditions which in turn taxes machines to the utmost; farmers deciding too late to get their older equipment in shape and above all in-grinding production tied down a large segment of our service man reserve.

Intensified serviceman training programs are now in progress in our company to restore the ratio of qualified servicemen to the amount of harvesting equipment that will be operating during the 1964 crop. We further are preparing service-operator schools for all those persons owning J & L Equipment in an effort to improve the farmers list echelon, preventive maintenance. The school dates will be announced on or about May 15th.

<u>Lesson Learned</u>: Out of wars come many good things, penicillin, sulphur drugs and on the like. If we let this past season slip from memory the sugar industry is heading for serious trouble.

When cane, regardless of variety, reaches 35 tons and above, down cane can be expected.

Today, such tonnages in Louisiana are commonplace and will continue to be. Moreover, we can no longer force our scientists to discard high yield varieties and hope to stay in business should supply meet demand

and sugar prices return to normal.

It is true that sugar consumption is on the increase in all countries due to population increase and up grading of living standards. But, sugar cane and beet producing areas of the world are also on the move at a fantastic rate. Colombia, as I know it, is planning seventeen (17) or more new factories, Mexico is in the midst of a crash program, Asia and Africa are increasing production to meet internal demand and gain a larger portion of world market. So, time is now becoming of the essence to the domestic cane producer and is compounded by the fact that we are chained to the machine.

What's New in the Future Machines: Our current model self-propelled will appear on the market shortly with many improvements over past model, heavier duty transmission and final drives, in keeping with the heavy horse-power hi- torque Diesel engines now employed, improved gathering system with manually adjustable front idlers that will permit the operator to make required adjustments to the gathers to meet the lean of cane and correct to proper distance above the row height. This modification will keep up-rooting and breakage of cane to a minimum. The topping mechanism will offer more clearance for cut tops and allow the bent tops to be rotated into a position for free discharge. A new tire size has been selected that will fit the full middle and yet have the high cane and rice field cleat not only on the face of the tire but also running up along the side wall to increase traction and yet forfeit a minimum of flotation over the low pressure high flotation tires offered on the 1962-63 models. A new front tire with a high way-in-field lug to keep them rolling through the mud. Besides other control improvements the structure will be strengthened to withstand the increased punishment now being inposed by deeper

quarter drains being created by mechanical drain cleaners and high angle cut crowning.

All of these new features will help lessen the dangers of losses due to fallen or wind blown cane.

However, as in every year since the inception of J & L, we are working on new machines and methods. Today, three altogether new models are in various stages of design and testing.

The average person may look upon the idea of three models as ridiculous and say, "why not concentrate on one and get it rushed to perfection and production?"

True, it would be much cheaper and certainly relieve the burden of cost and effort but you must realize what will work in an area of heavy rain fall will not necessarily work in an arid irrigated area where cultural practices are altogether different. In areas outside of Louisiana and Florida cane fully matures and topping cane is not quite as critical.

Disaster: A mat type harvester, or machine that did only partial topping would spell disaster to Louisiana at the early part of the crop where cane had to be cut low to gain sucrose. What would happen after a freeze when we have to almost cut the cane in half to get rid of sour tops?

From the side of economics can the Louisiana industry immediately finance a complete change from full stalk cane to cane cut into short lengths?

How much can we afford to spend in mill yard handling equipment changes and in factory modifications?

These four questions may in some way answer why J & L has taken the course of three experimental harvesters.

Research and development are expensive but essential items particularly when dealing with sugar cane. I've known no two harvest seasons to be identical.

If a cane harvester was as essential to the oil industry as it is to the cane farmer a sufficient number of dollars could be tagged onto the price for development without notice.

Though the gap is narrowing at a faster rate than ever before, testing and proving time still lie between the refined do-it-all, reasonably priced machine and 1964 market models.

The most dangerous of all quantities when discussing new harvesters is swaying the farmer into a wait-and-see attitude and go into another crop unprepared.

Transport and Mill Yard Handling: Digressing somewhat and overlapping other talks it may interest all of you to know that because of the type season experienced in 1963 the accident rate involving sugar cane transport equipment over Louisiana highways, by comparison has almost tripled over the past two years.

The Internal Revenue Service both State and Federal are questioning why excise tax and no licenses have been paid on cane wagons and tractors being used to haul on the highways. Cane highway trailers and truck-tractors are being tested for use tax and excess loading. If such taxes and penalties are added to our already uneconomical transport system, the Louisiana industry will no doubt find itself in not one but two expensive crash programs.

Let's all take a look at the whole picture, get feasibility studies made early so precious dollars won't have to be spent twice to accomplish the one objective.

LOUISIANA 1963 HARVEST
HARVESTING TRENDS FOR THE FUTURE

By
Marcel Mitchie
Thomson Machinery Company

Reports show that Louisiana 1963 production was more than 9,000,000 gross tons of cane. It is also reported that the average yield per acre was slightly better than 28 tons, breaking another all time record for tons cane per acre.

Considering the fact that there was an increase of 2 1/2 million gross tons cane over the 1962 production which averages 21 tons per acre, the later models of mechanical cane harvesters equipped with pickup attachments would have been able to cope with the increased tonnage per acre produced in 1963 had it not been for the heavy rainfall and winds of November 8th and 9th and at later dates during the harvest.

The Louisiana industry is advising, and justly so, our experimental and cane breeding stations to develop and continue to develop new varieties of cane which will give higher yields per acre and also to disregard to a greater and greater degree the fact that erect growing characteristics must not be the primary objective in the development and introduction of new varieties which have excellent qualities for growth and early maturity in this area.

New varieties alone are not responsible for the greatly increased tonnages produced in 1963, nor will this be true in the future, coupled with better seed cane available to the producer is knowledge, knowledge of better cultural practices gained through experience and through the efforts of our Universities, our Extension Services, the American Sugar Cane League, the U.S.D.A., our County

Agents and all of the many Agents, Societies and Associations which compile and disseminate valuable information to our cane growers.

With the prospect in the future of greater yields per acre we can envision year after year a great percentage of cane becoming recumbent and lodging even of its own weight after several rains, this then is the challenge to the Louisiana manufacturers of Cane Harvesters and to the industry. We can and will meet this challenge. During the recent harvest the manufacturers of Louisiana Type Cane Harvesters did meet this challenge.

When the 1963 harvest began in early October record tonnages were being cut daily, cane was erect or fairly erect and though tons per acre were high, harvesting and milling rate was excellent.

Heavy rains and winds in early November completely changed the picture when thousands of acres of heavy tonnage cane tangled and was blown or fell to the ground.

In certain areas which were hardest hit, at first it seemed that it would be impossible to cope with the problem which had so suddenly been thrust upon us, but by cooperation between the producer of cane, State Agencies and the machinery manufacturers, the determination to complete the harvest of this bumper crop became the prime target in the minds of all.

Harvester manufacturers were called upon by the industry to immediately begin construction of additional units which would be necessary to augment the hundreds of harvesters now operating in Louisiana, due to the decreased acreage which would be cut daily by harvesters in badly lodged cane, particularly in areas where cane had blown down with the row or parallel to the row, this is the most difficult condition for proper and efficient operation of a mechanical

harvester of contemporary design. Under these conditions harvesters will normally operate only in one direction, usually, depending on varieties, it has been found through experience that the harvester will function more efficiently in travelling in the direction in which the cane has been blown down, the operation of picking up the down cane and erecting for topping is made easier.

Thomson Machinery Division were beseiged with orders for new Harvesters, beginning at 7:00 A.M. November 8th continuing through several weeks. We had a very difficult decision to make, our first thought was that we could build probably 12 to 15 units in time to be of some assistance to the people who needed them so badly, but after about 3 days, or November 12th, we were completely swamped with orders for pickup attachments to be installed on older model Harvesters which cut perfectly well in erect cane but were worthless in badly lodged cane.

Small growers as well as large growers were affected. We decided that it would help more people in the industry if we made full use of available materials and manpower to install pickup attachments on twenty-five to thirty machines and to make modifications on new pickup attachments to enable these machines to operate in fields of heavy tonnage down cane.

Realizing that during the 1963 harvest everything went well for the first 30 days, from early October until early November leaving only 45 to 50 days for the producer to locate and bring into his territory hundreds of hand cutters to assist in the hard hit areas, as well as the stress put on all service organizations of all machinery dealers and manufacturers to keep the equipment going under the most adverse conditions possible.

Present models of Louisiana Harvesters did harvest better than 80% of all the down cane and 100% of all erect cane, of which there was appreciable acreage in many areas during the 1963 harvest.

Modifications which were made in front gathering chains by bringing the opposed chains closer to the center of the row, and lower down to the ground enabled the grower to cut cane which was down parallel with the row. No modification was needed in the pickup attachment if the cane was down or in an inclined position across the row.

There were and are still many harvesters which were built prior to the installation of pickup attachments on Louisiana Harvesters, which have been operating year after year in our fields. These units are obsolete and proved to be one of the great handicaps to certain growers in trying to successfully complete their 1963 harvest.

The rains, wind and severe freezes which followed the early November rains and winds were responsible for the known losses of reportedly 100,000 tons cane and contributed in great part to the unknown losses of cane left in the fields by mechanical Harvesters and Loaders, but in spite of all handicaps the industry not only produced but harvested a record crop.

Harvesting costs of down cane per ton of cane mechanically cut, increased, sometimes doubled, but not only because of down cane, heavy rains and wind contributed greatly to this increased cost.

It was found that in harvesting down cane, certain varieties were easier to handle with the machines than others.

NCO 310 in a much greater percentage than all other varieties went down flatter to the ground, but this variety was easier for the gathering chains of the pickup attachments to untangle, erect and

bring into the machine than all others, the stalk was not brittle and did not break in the process of erecting. 5268 and 36-105 created many problems during the harvest by breaking on coming in contact with the gathering chains.

A great deal has been learned in the hectic days of the harvest of 1963. We had almost every experience possible - heavier tonnage than ever before, rain, wind, lodged cane, freezes, necessity of getting hand cutters, service from your machinery dealers strained to the utmost, etc., etc.

Looking to 1964 the great point of encouragement to the Louisiana machinery manufacturer, however, is the cultural practice being used in Louisiana fields - 5 foot 6 to 6 - 0 row spacing is ample space for the machine to operate; cane being planted on the bank of row, lowest forward point of pickup attachment can get under lodged cane, and annual offbarring assures perfect row identification.

If it continues to be necessary to top cane and eliminate to the greatest degree possible the cane tops before milling, and we feel that this will be important in Louisiana as we do have freezes every year during the harvest season, and it then becomes absolutely necessary to top lower and lower or cane quality is decreased to a point that it is worthless, we must then strive to erect the greatest possible percentage of cane for topping, or devise and perfect another means of elimination of tops which have been frozen.

When harvesting cane mechanically in tropical areas, where, through 12 to 24 months growth, tonnages of 75 to 120 tons per acre may be attained, cane is mature, no possible freeze damage, good burning of fields before harvesting, tops of the small spike which is usually left on the end of a 12 to 15 foot stalk of mature

cane is of little importance to the mill in comparison to the 2 or 3 top joints of immature cane being harvested and milled in Louisiana.

With the full realization that topping is still a necessary evil in Louisiana for the time being at least Mr. Harold Willett, President and General Manager of Thomson Machinery Division of Lamb Industries, who has spent his entire life in the sugar industry, in Hawaii, Puerto Rico and for the past two years in Louisiana working with our Engineering Department during the last month of 1963 developed and built a prototype Harvester of unique design which embodies many of the better features of the present day Louisiana Harvester but a new concept of handling and conveying the cane immediately after it is cut at ground level proved extremely encouraging in several field tests conducted in 40 to 45 ton down cane, tests were made in both burned and unburned fields. As the idea was conceived in early December, the machine was only completed in early January, so conclusive full crop testing will be made in Louisiana during the 1964 crop.

The prototype is now being rebuilt and properly engineered around basic fundamental designs which proved to us during the tests recently made that we are on the track. An application for patents on certain features of the new Harvester is in process, we regret we cannot give more detailed information at the present time.

We do not believe that in the forseeable future Louisiana will find it necessary to use the types of Harvesters necessary in tropical countries or in the warm lands of Florida, eight to nine months growth is not conducive to 70 to 100 tons per acre.

We feel that future trends in harvesting in Louisiana due to

increased tonnages per acre will stimulate the manufacturer of Cane Harvesters to continuously search for and develop modification of present designs to increase efficiency of the present as well as new models and to devote time and money in research and development with the thought in mind of creating a somewhat new concept in mechanical harvesting.

Harvesting trends in the future must then embody not only mechanical Harvesters as such but must include the whole system, cutting, loading, transport, millyards and simple comparatively inexpensive cleaning and washing devices installed at the mill.

Although our costs of harvesting, loading and field transport of cane in Louisiana are low in comparison to other mechanized areas, both in operating costs as well as capital investment, we must improve our methods of transportation and cane handling at the mill.

Elimination of chain slings, and man power at the mill yard as well as in the field can and must be done in Louisiana as it has been done in several other countries and in Florida. You are all familiar with the manifold chain net system of unloading and the side dump cane wagons used in Florida, we have built many of these Florida wagons and recently have improved this design, eliminating the complicated linkage of the Florida wagon which is necessary to open the side for dumping.

We now have 40 of these newly designed side dump wagons just starting operations at the Guneid Mill in the Sudan.

We do not yet have movies and pictures of these units in operation nor do we have cost figures available, but in the next few weeks they will be available.

We have also shipped to the Guneid Mill in the Sudan a Cane Feeder Table equipped with washing and cleaning device, and specially designed unloader for use with the side dump wagons.

Experience gained by your Louisiana manufacturers in the Sudan, Florida, Puerto Rico and foreign cane growing countries around the world has and will continue to benefit the cane grower of Louisiana, although field and climatic conditions may vary to the extreme.

The more ideas, the more thoughts which can be brought forth at meetings and gatherings of this sort, throughout the sugar world, and the exchange of these creative ideas can and will insure the success of our industry.

Therefore I ask that close contact between the grower, the processor, the scientist, people who are assembled here, and your manufacturer of highly specialized cane machinery must be continuously increased.

Your manufacturer needs this. He needs your views, your ideas.

CONTINUOUS CENTRIFUGALS OPERATING PROBLEMS

Dr. Arthur G. Keller
Chemical Engineering Department
Louisiana State University

The commercial acceptance of continuous centrifugals for processing low grade massecuites marks a major advance in the technology of cane sugar production. The continuous unit offers the advantages of high capacity, a uniform rate of power consumption, a very simple and trouble-free operation and, the advantage of economies in labor and maintenance. This discussion will be confined to that type of continuous centrifugal which employs the principal of moving a thin film of the order of 1/4" to 1/8" thickness over the surface of a conical basket lined with a smooth perforated metal sheet. The massecuite is separated into a relatively high grade sugar which goes over the lip of the conical basket and a molasses which goes through the perforations in the screen.

The majority of the machines in use employ a basket mounted on a vertical shaft and driven from below by a constant speed motor. The basket is conical in shape with the apex of the cone at the bottom. The angle of the sides vary from 25-30^{o} and basket diameter is usually of the order of about 30". Most machines are belt driven with a motor which ranges from 25-40 HP in capacity. Basket speed is in the order of 2,000-2,500 rpm.

In service, under Louisiana conditions, continuous centrifuges have been able to handle from 80-160 cu. ft. of crystallizer massecuite per hour per machine. It is generally conceded that 120 cu. ft. of massecuite per hour per machine is a conservative figure. Actual throughput of a machine will vary depending upon the

mesh of the screen employed, the temperature and viscosity of the massecuite, and similar factors most of which have to do with the type of massecuite being centrifuged. One valuable consideration is the fact that continuous centrifuges seem to handle massecuite with an irregular or "false" grain quite satisfactorily while batch type centrifugals are unable normally to process this type of material at all.

For best results, continuous centrifuges should be supplied with massecuite of relatively constant composition, temperature, and at a uniform flow rate. While these centrifugals will handle massecuite at almost any temperature, they will do a much more effective job if the massecuite temperature is carefully controlled. In addition, the greatest capacity and generally the most satisfactory work is obtained by adding a limited amount of water and/or steam in the basket during the operating cycle. Normally the idea of adding water or steam to a third massecuite is considered almost heresy in the sugar industry largely because of the problems of dissolution of crystals and an increase in the purity of the molasses. This does not seem to be the case with continuous machines largely because of the very thin film of material being processed and the short time of contact of the water or steam and the massecuite or sugar.

There have been two major complaints by users of continuous centrifuges. The first concerns the question of the purity of the resultant final molasses. Some operators have reported that the purity of the final molasses obtained when purging a given massecuite on a continuous machine will be higher than that obtained from other portions of the same massecuite purged on a batch type machine. This seems to be a matter of operation rather than an inherent defect in

the machine itself. In well operated plants where the massecuite temperature, flow rate of water, and similar operating variables are properly maintained, the purity of the final molasses obtained from a batch type centrifugal and that obtained from a continuous centrifugal are identical. Investigation of numerous complaints of high molasses purities from continuous centrifugals has in most cases shown that the operators have been careless in the use of wash water or steam or in the control of the massecuite temperature. They have either permitted the use of excessive amounts of water or steam, or have overheated the massecuite, or have done both. With good control and supervision, there is no inherent reason why the continuous machine should not do as well as the batch type centrifugals.

The other problem which has arisen is that of excessive screen wear. This is a problem which appears to be peculiar to the raw sugar industry. Centrifugals operated in beet factories and in cane sugar refineries have had no unusual problems with centrifugal screen wear. In one case a combination raw sugar factory and refinery during its refining period operated for several months without screen problems. As soon as their grinding operation commenced, they began to have problems with excessive screen wear. This situation then seems to be related directly to something present in the cane juice or the cane sugar. It will be the purpose of this discussion to explore some ideas as to the probable causes and sources of trouble encountered in centrifuging low grade massecuites in raw cane sugar factories. Information on comparative density and purity of samples of molasses taken from batch and continuous centrifugals when purging parts of the same massecuite is submitted in Tables 2 and 3. This information was obtained through the kindness of Mr. Victor J. Bailliet, Caldwell

Sugars Company, Inc. An inspection of the tables indicates that the density of the molasses from continuous centrifugals is consistently lower than that obtained from batch centrifugals by between 1 and 2 degrees Brix. This is to be expected since it is common practice to use exhaust steam and/or hot water to improve the operation of the continuous centrifugal. This also improves the fluidity of the massecuites being handled.

The reported higher purity of the molasses from continuous centrifugals as compared to that from batch centrifugals is not substantiated by the data shown in these tables. The continuous centrifugals can produce molasses of considerable higher purity but when this happens it is usually an indication of improper operation. Improper operation can include damaged screens which to permit the passage of sugar, use of excessive amounts of water or steam, or both, and overheating the massecuite being purged. Another and very common problem is that of poor quality sugar boiling. Frequently the low grade strikes contain very irregular and extremely fine grain. It is quite probable that much of this fine grain passes through the screens of the centrifuge and contributes to the higher purity of the molasses.

With proper attention to operating conditions to insure a uniform massecuite temperature, water and steam at constant pressure and temperature, and at properly controlled flow rates most of the reported difficulties with continuous centrifugal operation can be eliminated. One of the problems which appears to be common to any equipment which operates well is that it receives little attention. This seems to be a major source of trouble with continuous centrifugals since they will operate with little or no attention. This results in

poor operation at times because of too much water or steam or improper massecuite heating. Where care is exercised to provide the necessary supervision, the machines will do more and better work, and at a lower cost than will batch machines when handling the same massecuites.

The problem of screen wear has been a major obstacle costwise in the operation of continuous centrifugals. It has been reported that screen wear in some sugar areas has been relatively minor. It has been excessive in numerous Louisiana factories. The following observations have come to our attention from other areas and other types of industries. It is reported that continuous centrifugals operating in beet sugar factories and in cane sugar refineries have had no difficulties with screen wear compared to those experienced in ordinary raw cane sugar factory operations in Louisiana. In the case of one Louisiana plant which operates a combined refined refinery and raw sugar factory, it is reported that screen wear during the normal refining season is virtually nil whereas screen wear during the regular cane grinding season has been excessive on occasions.

The problem of screen wear is a very real one since the replacement of screens is time consuming and costly. The information which appears in Table 4 was obtained through the kindness of Mr. Clarence Steele of the Silver Engineering Works, Inc. The results reported cover samples of crystallizer sugar and final molasses from three different Louisiana factories. In all cases the sugar was dissolved in clean water and filtered to recover the insoluble residue. A similar procedure was followed with the final molasses. It is rather interesting that the residue in both sugar and molasses was principally silica or siliceous in nature. All the constituents of residue have not been determined.

Samples of crystallizer sugars and some final molasses samples have been collected from a number of Louisiana sugar factories during the past grinding season and will be examined later. The results of these studies will be reported at a subsequent meeting of the Association.

The presence of extremely fine particles of silica sand in the sugar and molasses samples may be the explanation for excessive screen wear. This seems to be substantiated by samples of screens which have failed in service. The screens upon examination with a magnifying glass show that a number of openings are plugged with particles which apparently are fine grains of sand. Where plugging does occur there is erosion of the screen downstream from the point of plugging. This results in striations or streaks on the reverse side of the screen. This is illustrated by the sample screen which is being passed around and which was obtained from one of the operating Louisiana factories during the past grinding season.

The source of the abrasive residue which has been found in crystallizer sugar and final molasses is not known. It is possible that the silica may represent sand or dirt particles which have gotten into the material by accident. It is difficult to conceive that sand particles would have gone through the clarification and evaporation process as such. There is also a very strong possibility that these materials are the result of precipitation of silica from either syrup or molasses because of concentration effects. The removal of this material could be effected using continuous disc or bowl type centrifuges. The economics of purification by centrifuging require study to determine whether this operation would be justified.

The possibilities for reducing wear or abrasion by using harder materials for screen construction are presently under study. Hardening of the surfaces of the screens does seem to be one partial answer to the problem.

The above information is presented in the hope that it will stimulate interest and further study of the matter by the industry. There are a number of persons present today who have had exhaustive experience with continuous centrifuges and it is felt that they may be able to contribute further to this subject.

TABLE II

COMPARATIVE FINAL MOLASSES ANALYSES
CALDWELL SUGARS CO-OPERATIVE INC.
1962 CROP

DATE	HOUR	BRIX		PURITY	
		BATCH	CONTINUOUS	BATCH	CONTINUOUS
11/9	-	93.82	92.28	26.01	26.00
11/10	9:30 PM	93.02	93.40	28.38	30.15
11/12	9:00 PM	94.22	92.82	30.14	28.44
11/13	8:50 AM	93.24	86.74	28.31	31.45
11/14	12:30 PM	95.56	92.96	28.09	29.58
11/17	11:40 PM	95.80	95.00	31.31	31.15
11/18	-	95.36	94.76	29.07	29.71
11/19	9:25 AM	94.60	92.20	30.23	30.54
11/20	9:05 PM	95.44	93.04	30.17	30.09
11/21	12:30 PM	94.92	92.02	28.66	28.69
11/23	4:10 PM	94.14	91.34	30.38	31.31
11/25	11:00 PM	94.56	91.56	30.75	31.23
Averages:		94.56	92.34	29.29	29.86

TABLE III

COMPARATIVE FINAL MOLASSES ANALYSES
CALDWELL SUGARS CO-OPERATIVE INC.
1963 CROP

DATE	HOUR	BRIX BATCH	BRIX CONTINUOUS	PURITY BATCH	PURITY CONTINUOUS
12/6/62	7:15 AM	95.00	91.60	32.27	35.07
	1:10 PM	91.00	91.20	32.39	33.77
	6:30 PM	93.20	91.28	32.94	35.67
	4:00 PM	93.40	90.40	35.33	36.01
12/7/62	8:30 AM	95.20	92.20	34.20	34.36
	12:05 PM	96.20	92.80	35.21	35.08
	12:15 AM	95.00	91.40	34.74	35.62
12/8/62	5:15 AM	94.40	91.40	34.49	35.14
	9:30 AM	95.00	92.00	32.88	33.96
	1:35 PM	95.00	92.20	35.20	35.79
	7:25 PM	95.10	91.70	36.55	34.02
12/9/62	1:05 AM	94.40	91.60	35.89	36.51
	5:15 AM	94.60	92.60	34.42	35.16
	3:50 PM	94.36	91.36	34.97	35.63
	8:50 PM	93.86	92.10	35.16	35.35
	12:50 AM	93.46	91.66	35.42	36.00
AVERAGE:		94.36	91.22	34.75	35.20

TABLE IV

RESIDUE FROM THIRD SUGAR SAMPLES

Sample	Residue	Comments
Factory A		
500 gr. sugar	.373 gr.	Mostly fine silica approximately .002 - Some magnetic material
325 gr. mol.	.109 gr.	Mostly silica
Factory B		
500 gr. sugar	.111 gr.	Some silica - larger particles than Factory A. Some + .005 Some fiberous material
325 gr. mol.	.107 gr.	Mostly silica
Factory C		
500 gr. sugar	.128 gr.	Very small amount of silica - Balance mostly flaky and magnetic
325 gr. mol.	.115 gr.	Mostly silica

BRIDGE CRANE vs REVOLVING DERRICK USED FOR CANE STORAGE AND MILL FEED

By
Joseph M. Pugh
J & L Engineering Co., Inc.
Jeanerette, Louisiana

To many engineering consultants, sugar mill engineers and owners, it has been a challenge and a keen desire to have the opportunity to design and construct a completely new sugar cane mill and factory.

This fact became a reality to many because of the recent vast expansion of the sugar industry in some areas throughout the world.

The rise of the Communist dictator, Fidel Castro, with his nationalization and abuse campaign against the U.S. forced this country to stop buying sugar from Cuba. This brought about the task for the U.S. to allocate quotas to other sugar producing areas to fulfill the three million or more tons of annual supply from Cuba.

The continuing rise of the standard of living throughout the world coupled with the ever-increasing population also contributed to the need for expansion of the sugar industry.

Florida, sensing the opportunity to expand its sugar industry, induced many vegetable growers and ranch operators to convert their "warm lands" (areas surrounding the southern shores of Lake Okeechobee) into sugar cane fields. During the fall of 1961, J & L Engineering Co., Inc. was approached by a group of these new sugar cane growers to submit to them a feasibility study for a modern, efficient method of cane handling from the field to the main carrier of the mill.

This challenge was readily accepted and our Engineering Department began its research and investigation of the problem. Being quite familiar with the Louisiana method of harvesting, we at

first thought that with some modifications it would be the most economical and efficient method. However, calculations and cost systems brought about quite a surprise to everyone. The preliminary study contained one hundred and fifty-six (156) combinations of systems for cutting, loading, field transporting, transfering, highway transporting, unloading and mill feed and storage. The final study which was accepted and put into operation contained the use of a traveling bridge crane with grapple to store cane during the day and feed mill at night.

Because of time limitations we will not discuss the complete system. This paper will concern itself only to that part of the handling system at the mill yard proper, and will endeavor to point out the advantages of a traveling bridge over a rotating derrick for cane handling at this location.

Basically, there are several factors to consider in the selection of this type of equipment, namely:

Area Requirements
Traffic Pattern
Capacities
Time Cycle
Stability of Operations
Controls & Safety
Development
Manpower Requirements
Operator
Cost

The above factors will be handled separately and will present objectively the pros and cons of the two handling devices under question.

Figure one (1) shows a typical layout of the cane handling area of a Louisiana sugar cane factory of the following specifications:

Grinding rate of 3,200 short tons in 24 hours or 133 tons per hour. Cane delivered by both highway semi-trailer and field carts in trains of two, Two guyline type revolving derricks with a horizontal boom and trolley thereon of sixty (60) foot radius are used to unload, feed mill and store cane during daylight hours with spreader bar attached to lifting hook. At night, a grapple replaces the spreader bar and is used to feed mill from storage pile to feeder table. A dragline or crane is located between derricks and adjacent to main carriers to supplement unloading and feeding of mill during unloading period. Grab capacity approximately 4 to 5 tons with maximum capacity of each derrick or eight to nine tons.

Figure two (2) depects a layout of cane handling area of a sugar cane factory of the following specifications:

Grinding rate of 3,500 short tons in 24 hours or approximately 145 tons per hour. Cane delivered by both side dump highway semi-trailers and field carts in trains of four. One hydraulic unloading station for direct feed to mill on inclined feeder table. Two hydraulic unloading stations for dumping into storage. One 100 foot span traveling bridge crane of 10 ton capacity equipped with 5 ton capacity grab is used to move cane from dumping area to storage during unloading period and feed mill during night operations. Traveling bridge always keeps feeder table full to supplement direct unloading, if needed. It can also feed mill during unloading period if required. The length of runway is 220 feet.

The chart shown in Figure three (3) will give a breakdown of area comparisons.

	Revolving Derrick	Traveling Bridge
Total of Cane Handling Area	35,520 sq. ft.	22,000 sq. ft.
Area Available for Storage	18,640 sq. ft.	16,120 sq. ft.
Percentage of Storage Area to Total Area	53%	74%
Maximum Clearance Under Grab	30 ft.	30 ft.

Fig. 3

It can readily be seen from the chart, Figure 3, that approximately 50% more space is required for the cane handling area when revolving derricks are employed. This does not consider the area used for guyline anchors, if this type of derrick is used, and jacks whenever more height under guylines are needed.

When we consider the area available for storage for both systems, the chart shows the vast difference in usable space. A minimum of fifteen (15) feet is required around the center of derrick for clearance purposes. The area where the delivering vehicle is unloaded is not usable for storage. Because of the circular operation of the derrick, the corners are lost from the overall rectangular cane handling area.

In both cases the feed table and main cane carrier to mill are deducted for storage.

The traveling bridge, operating in a linear pattern, utilizes all of the overall rectangular cane handling area except that portion where ramp for unloading is located.

A review of the percentage of storage area to total cane handling area reveals the startling fact that nearly one-half (1/2) of the land is lost for storage when the revolving derrick is utilized. Only twenty-five (25) per cent is lost in the traveling bridge system.

The revealing factor derived from the chart is that the total square footage lost for storage in the revolving derrick method will nearly equal to the storage area required for the traveling bridge and is approximately twenty (20) per cent short of the total area requirements.

It is a known fact that land values in Louisiana, in fact,

most everywhere, are at a premium. Therefore, this is a major consideration, especially in new construction, when equipment selections are made.

TRAFFIC PATTERN

The traffic pattern of delivery vehicles in a cane handling area of a sugar cane grinding mill is a most important element in the efficient operation of the unloading facilities.

A well defined route which remains constant and requires little or no driver instruction is most desirable. A crisscross pattern where there are no defined or established paths for the vehicles would tend to create confusion, loss of time and, in some cases, cause accidents.

A comparison of Figures 1 and 2 will clearly show a simple traffic flow pattern in the traveling bridge layout while a crisscross pattern of some complexity is brought about in the revolving derrick layout. Other flow systems and patterns could be laid out for each, but location requirements and circular operation of the revolving derrick will always result in a traffic problem.

TIME CYCLE

The speeds for rotating derricks and bridge cranes were obtained from specifications of a leading manufacturer of bridge cranes and derricks.

The acceleration and deceleration rates were kept the same for both derrick and crane. You will note (Figure 4) that the difference in line speed, trolley speed, and bridge or slewing

speeds determine the time and distance traveled during the acceleration and deceleration cycle.

In calculating the time cycles of these two type cranes an average distance was used for mill feed during night operation and cane storage during the day. See Figures 5 and 7.

MILL FEED:

Using the bridge crane to feed a 3,500 tons per day mill a feed rate of 145 tons per hour is required. You may see from the chart (Figure 6) that a total time of 48.9 seconds is required to complete one cycle. Applying a fatigue factor of 1.2 we obtain a time of 58.7 seconds per cycle or 61.4 cycles per hour. With an average grab load of 5 tons a capacity of 307 tons per hour is reached. This is far in excess of the mill grinding rate of 145 tons per hour.

With derricks feeding a mill with a capacity of 3,200 tons per day a grinding rate of 133 tons per hour is required. From the chart of Figure 7 we see that 80 seconds are required to complete a cycle. With a fatigue factor of 1.6 (due to mechanical controls and operator position) a time of 128 seconds per cycle is obtained which gives 28 cycles per hour. Using an average grab load of 5 tons, mill feed rate is 140 tons per hour. This is too close a margin for one unit to feed mill, therefore two derricks are required.

STORAGE:

The 3,500 tons per day mill has bridge crane storage and direct mill feed during the 8-hour hauling period. This means that two-thirds of the total capacity or 2,300 tons of cane must be put into storage for night operation. From Figure 8 we see that the bridge

crane is capable of storing 300 tons per hour or 2,400 tons in eight hours. This is more than adequate to store the required amount of cane. With derrick storage at the 3,200 tons per day mill, a mill grinding rate of 133 tons per hour must be maintained. Mill feed is from a 100 tons per hour crane taking cane from field carts. This must be supplemented at 30 tons per hour with the derricks keeping the feeder tables full during the 12-hour hauling and storage period. From Figure 8 it is seen that one derrick is capable of storing 95 tons per hour. Subtracting the 15 tons required for mill feed leaves a net storage of 80 tons per hour per derrick. This gives a total of 160 tons per hour for the two derricks or a total storage capacity of 1,920 tons in 12 hours. This is approximately 20% more than the required 1,600 tons.

From the above considerations it can be concluded that the bridge crane would be more desirable due to the faster speeds and ease of handling.

CAPACITIES

The cane handling layouts shown in Figures 1 and 2 will be compared throughout this paper because of their approximate equal grinding rates and grab capacities.

With the exception of a very few installations, all of the mainland sugar cane harvesting operations are carried on during daylight hours. The transporting from field to mill is also scheduled for daylight movement. Therefore, cane has to be stored for night operations. The unloading facilities are then required to handle cane for storage at a rate of over twice the grinding rate of the mill. This is assuming that approximately nine to twelve

hours are expended for unloading.

As pointed out in the previous factor considered, namely, Time Cycle, two revolving derricks with spreader bar attached to lifting hook, handling chain sling bundles of approximately four tons each, are needed to handle the cane going into storage for night operations. These units with an average storage rate of 95 tons per hour are taxed to the maximum to maintain required storage rate. A dragline or crane is used to feed mill during unloading period and has a capacity of approximately 100 tons per hour. The additional thirty-three tons needed to maintain grinding rate of 133 tons per hour has to be furnished by revolving derricks.

Any lost time for any reason will result in shortages of cane when utilizing equipment and top rated capacity. Most mill managers realizing the critical area of operation, will allow more cane stored than the average, approximately 10% over that required for 24 hour grinding. Taking advantage of mill shut-down periods and extending unloading time will provide the added stored cane. As much as 30 to 50% has been allowed to assure even grinding rate. This will eventually result in "stale" cane at the bottom of the storage pile, because the area is seldom completely cleaned out in a 24 hour period.

A look at the time cycle of the traveling bridge crane shows a feed rate of 307 tons per hour. This is over twice the grinding rate. As pointed out above, during unloading and going into storage, twice the grinding rate is required of the handling unit. This is easily accomplished with a traveling bridge with enough excess to adequately assist in feeding mill if needed.

The following chart will bring out the capacity advantages of

a traveling bridge for mill feed, storage and/or mill feed and storage:

10 HOUR UNLOAD PERIOD

Unit	Required Grinding Rate Tons/Hr.	Required Storage Rate Tons/Hr.	Capacity for Storing Tons/Hr.	Capacity for Feeding Tons/Hr.	+ - Storing	+ - Feeding	Number of Units
Revolving Derrick	133	186	160	280	-26	+147	2
Traveling Bridge	135	186	300	307	+114	+172	1

STABILITY OF OPERATIONS

In the construction of a traveling bridge crane there are few limitations on the width of bridge beams and length of trolley. This allows for a wide spread of cable drums and length of each. This factor widens the holding and hoisting lines to grab. This width of attaching points will greatly stabilize the grab during operations.

High speed of bridge travel and trolley movement gives the operator a means to stop any development of pendulum action of the grab.

This is not true of the revolving derrick. Its construction limitations are many and will not allow for a large spread of attaching points to grab and sheaves on trolley. Its circular operation along with its particular movements will easily develop pendulum action. A very skilled and experienced operator is required to maintain this control.

Mill owners who have revolving derricks for the cane handling facility of the factory are well aware of the damage caused by

this factor to feeder table, "bull pen" or retainer for storage area, and the derrick cab itself.

CONTROLS & SAFETY

The previous factor discussed the point of stability of grab resulting from varied control of the two types of mechanisms.

The actual controls of each unit are just as varied.

The traveling bridge in use for sugar cane handling in most operations are entirely electrically controlled. These controls are equipped with sequence switches, limit switches, safety cut-offs, sequence brakes, etc. Every available safety device and control is incorporated to reduce the human element factor in its operation.

The minimum amount of this type of controls and safety devices are available for rotating derricks. Because of its basic operating characteristics only a few of these elements can be utilized. Therefore, the human element factor is great in the operation of a rotating derrick.

The question arises as to why is this factor a disadvantage. Automation is being accepted in our industrial growth not only for its labor-saving feature but also because it reduces the human element factor in the operations of complex machines and systems.

It can be said that the control of a bridge crane is closely approaching automation while the revolving derrick is restricted in this approach.

DEVELOPMENT

Demand and necessity for a service or commodity always brings about more development and research. A product which has limited use and low sales volume does not lend itself to dollars being spent in development.

Traveling bridge cranes are used extensively throughout industry the world over. Much advancement and development in construction, controls, speed, comfort, etc. have been incorporated in later designs. Efficiency of operation, regardless of type of material handled have been greatly increased.

The demand for revolving derricks has decreased over the years and many major manufacturers have discontinued its production.

In evaluating the merits of equipment, the development factor is of prime importance. No one would consider buying an obsolete automobile. It then follows that the selection of equipment which is continually being improved upon and research and development programs of the manufacturers remain effective, is well founded.

MANPOWER REQUIREMENTS

We will again use the cane handling facilities shown in Figures 1 and 2 to make a comparison of labor requirements. Let us consider the number required when using rotating derricks:

UNLOADING SHIFT	
Derrick Operators	2
Crane Operators	1
Chain Handlers	
(3 per derrick)	6
(2 per crane)	2
Scrappers	2
Foreman	1
Total	14

Labor force for Traveling Crane operation:

UNLOADING SHIFT

Bridge Crane Operator	1
Direct Feed Unloaders	2
Storage Feed Unloaders	2
Scrapper	1
Foreman (Relief Operator)	1
	7

This clearly points out the advantage of the traveling bridge crane as a labor-saving device. As stated herein, the complete system has to be considered in the evaluation. In either case the labor requirements are reduced with the installation of a traveling bridge system.

COST

The two charts below show the approximate hourly owning and operating cost for each system of sugar cane handling.

Estimated Hourly Owning & Operating Cost

10 TON CAPACITY ROTATING DERRICK

Estimated Cost	$90,000.00
Depreciation Hours = 30 yrs. x 70 days x 24 hrs. =	50,400 hours

Hourly Owning Cost

90,000 ÷ 50,400 = Depreciation =		$1.785
Int., Ins., & Taxes (.03/1000) x 90,000.00 =		2.700
	Total	$4.485

Hourly Operating Cost

Fuel:	22.38 kw-hr. x .025 kw.hr. =		$ .560*
Lube Oil - Trans. :	.015 x 1.20 per gal. =		.018*
Grease -	.05 lb./hr. x .20 per lb. =		.010*
Repairs -	40% Dep. Per Hr. =		.710
Storage -	500/1680		.297
Operator's Wage			2.150
		Total	$3.745

Hourly Owning Cost		$4.485
Hourly Operating Cost		3.745
	Total	$8.230

*Florida rates

10 TON CAPACITY BRIDGE CRANE

Estimated Cost	$95,000.00
Depreciation Hours	50,400 hours

Hourly Owning Cost

95,000 ÷ 50,400 = Depreciation =		$1.88
Int., Ins., & Taxes (.03/1000) x 95,000.00 =		2.85
	Total	$4.73

Hourly Operating Cost

Fuel:	22.38 Kw.Hr. x .025 kw. hr. =		$ .560*
Lube Oil - Trans.	.015 x 1.20 per gal. -		.018*
Grease	.05 lb./hr. x .20 per lb. -		.010*
Repairs	30% Dep. Per Hr.		.560
Storage	500/1680		.297
Operator's wage			2.150
		Total	$3.595

*Florida rates

Hourly Owning Cost	$4.730
Hourly Operating Cost	3.595
Total	$8.325

It has been brought out in a previous factor evaluation that two revolving derricks are required versus one bridge crane for an equal capacity mill operation. Time does not permit going into a detailed study of other cost factors required for both installations. However, a glance at the owning and operating cost when doubled for the revolving derrick will surely favor a decision toward a traveling bridge.

These total figures are available in other studies and can be substantiated to prove a favorable decision for bridge cranes.

EXPANSION

A factor not considered separately but one that is of major importance is future expansion. Everyone in the factory and of the Louisiana Sugar Industry is familiar with the problem brought about in the cane handling area whenever the grinding capacity is to be increased. Locations, area requirements, traffic pattern, etc. in most cases present insurmountable obstacles.

A look at Figure 2 and 2A depicts the ease of expansion of this type of handling system. More runway beams are added at each end, another bridge is installed with each allotted one end for working, adequate controls to prevent overlapping of work area, more dumping stations are set up, etc.

As stated on each layout, Figure 1 is of 3,500 tons capacity, The other shows an expansion to 8,000 tons capacity per 24-hour day.

CONCLUSION

Time does not permit me to go into a detailed study of this presentation but in briefly summarizing the points we have covered I would like to leave you with the following remarks.

The overhead bridge crane is not an experiment in the cane industry; on the contrary, it is a proven method of handling cane which can truly enjoy such descriptive phrases as, time-saving, labor-saving, orderly, safe, and most important, the best money saving system man has yet devised for the sugar industry. I would like at this point to inject a word of caution, however. Unless the bridge crane is used with a similarly efficient system of bulk handling from the field to the factory it would not meet the standards I have described above.

Thank you.

VIBRATING SCREENS FOR SUGAR MILL JUICES

W. P. Stilz
Manager, Vibrating Screens & Vibrating Feeders
Link-Belt Company

There are an increasing number of sugar factories throughout the world utilizing vibrating screens for the straining of mill juice. The capacity, dimensions and ease of installation of the type of screen being furnished for such applications permits a great deal of flexibility in meeting the existing space requirements and location.

What is a vibrating screen? A vibrating screen is a structure with means for producing a rapid motion with one or more perforated or mesh surfaces for separating material according to size. The effectiveness of the vibrating screen depends on a rapid motion. A vibrating screen normally operates at speeds of 1000 to 2000 RPM with motions of 1/32" to 1/8".

A successfully operating screen must accomplish a combination of the following functions:

1. Conveying of material retained on the screen surfaces.

   This must be done to uncover the opening so that the cloth can pass the undersize material or liquid.

2. Distribution of the material.

   In order to take full advantage of the area of the screen, the material must be distributed over the surface to insure efficient screening. The motion of the deck should distribute the material over the deck evenly.

3. Agitation of the bed of material on the screen surface.

   Agitation and stratification are required to open the bed so that the fine particles or liquids can work their way down through the

large particles and pass the opening.

4. <u>Dislodgment of particles which stick or wedge in the opening</u>.

   Particles which possess dimensions having merely the same size as the opening will clog. The motion of the screen must dislodge these particles.

5. <u>Detention before discharge</u>.

   For high efficiency, sizing or removing solids from liquid it is desirable to retain the oversize as long as possible. The material must be moved faster at the feed end to obtain quick distribution and a shallow bed where the volume is least, the rate of travel should be slow to allow the remaining fines or liquids to be removed.

A comparison of vibrating screens with other methods of handling sugar mill juices show the following advantages:

1. The vibrating screen requires less horsepower for operation.
2. The square foot floor area and the floor loading rates are less than required for other methods of screening.
3. The vibrating screen is easier to clean; as a result it cuts down on inversion.
4. The vibrating screen is easier to maintain.
5. The vibrating screen is more compact and when furnished completely with a steel tank it is a self-contained unit. The steel tank reduces to a minimum the amount of supporting structure required.
6. The vibrating screen produces a dryer discharge due to its motion.

Let us now look at the mechanical features of the vibrating screen.

Fig. 1 - Two-Bearing Vibrator Unit

1. The vibrating screen consists of a shaft turning in a pair of bearings. The shaft carries unbalanced weights, either machined into or keyed onto the shaft. This assembly is normally driven by a V-belt drive. When the unbalanced weights are rotated the screen follows the weights through a path. When the vibrator is placed on top of the box a slight rocking action will take place resulting in an elliptical motion with the ellipse leaning toward the vibrator. This motion tends to move the material away from the feed end and retard it at the discharge end.

Fig. 2 - Spring-Mounted Vibrating Screen

2. On most vibrating screens the cloth is pulled tightly across the longitudinal steel members equipped with rubber caps. The cloth may be easily changed by loosening the tension bolts and sliding the cloth out at either the feed or discharge ends.

   The screen box is mounted on springs or rubber blocks to keep the vibration from being transmitted to the supports. The screen box is normally equipped with a woven wire screen cloth, although where conditions require it, it can be equipped with a perforated plate. For the handling of mill juices stainless steel screen cloth is recommended. Openings ranging from 15 mesh to 30 mesh are normally used in the screening of primary juices.

In our discussion of vibrating screens a term is used to designate the opening with which the unit is equipped. This term is "mesh". Where the terminology "mish" is used it refers to the number of openings to the lineal inch. The mesh is counted by starting from the center of one wire and counting the number of openings to a point 1" distant. If the count does not work out to an even number, the fractional point of the opening is specified. As an example - 20 mesh indicates 20 wires to the lineal inch. The actual opening between the wire is known as a space, thus 1/4" space 135" wire implies that the wires are 1/4" apart and the diameter of the wire is .135".

On most applications a double crimp square weave cloth is used, such as shown on the slide. Double crimp wire is woven in a manner so as to arch the chute by the transverse wire over the warp or longitudinal wire and the warp wire over the chute. By doing this each wire forms a support for the other keeping both wires tight and rigid, thus eliminating slipping or shifting of the wire. Several types of slotted cloth are available to give greater open area and give greater strength of wire. One type has a slot approximately two times the width of the opening, the other type has a slot six to eight times the width.

It should be borne in mind that the capacity of the vibrating screen on mill juice is determined by the percentage of open area of the screen cloth. With this in mind the cloth must be selected with the proper combination of strength of wire and percentage of open area.

One of the primary uses of the vibrating screen is to screen the raw juice as it comes from the mill replacing the conventional drag type trash elevator.

In some instances factories have retained the trash elevator, but find it desirable to eliminate more of the bagacillo than is possible by the cush-cush elevator; they have installed vibrating screens for secondary screening.

Vibrating screens are also used for screening of hot clarified juices.

In modern mills with an intensive preparation of cane before milling the amount of fine bagacillo present in the screened mixed juice varies from mill to mill. A reduction of the fine bagacillo in screened mixed juice with stationary screens to a satisfactory level becomes extremely difficult, and in many cases even impossible. In all modern mill tandems it is essential that the juices are subjected to a screening process to remove the disintegrated bagasse as completely as possible. The quantities of fine bagasse present in mixed juice show tremendous variations from mill to mill. The quantity depends on the quality of the cane, system of disintegration before milling, and last but not least, the mill settings and particularly a proper setting of the bagasse carrier in relation to the feed rolls of the mill. Another important element in the introduction of fine bagasse in mill juice is the amount of bagasse removed by the scrapers from the Messchaert grooves.

It is desirable to remove as far as possible the fine bagacillo from mixed juice to obtain the proper setting in the clarifiers as the bagacillo by its specific gravity is very difficult to settle.

When it is present in considerable quantities, it increases the volume of mud juice or cachaza and is one of the main suspended non-sugars to which remains attached small air bubbles which can only be removed by intensive heating or boiling in flash pans as otherwise

this fine bagacillo combined with fine air does not settle at all, but remains as suspended matter in the clarified juice.

In addition, the presence of suspended matter in the form of disintegrated bagasse results in mechanical difficulties in the handling of juices, such as clogging valves, pumps and juice heaters. With the introduction of chokeless pumps it has become possible to transport juices containing a high percentage of coarse suspended matter, such as fine bagasse.

By a proper arrangement of the pumps and a satisfactory design for distribution of the juices when they are returned to the mill for inhibitation, the necessity for screening anything but the processed juices is eliminated.

Fig. 3 - NRM 138 Vibrating Screens Handling
Unstrained Sugar Juice at 20 Mesh

Many mills have found that by the application of vibrating screens using a 20 mesh screen cloth it is possible to reduce the bagacillo content in mixed juice in all conditions of milling to an average valve far below that obtained with the conventional juice strainer.

Fig. 4 - Three NRM 138 Vibrating Screens
Handling Secondary Juice at 30 Mesh

Where conventional trash elevators are installed the vibrating screen can be used for secondary screening of the juice to further remove the bagacillo content. While this is a satisfactory arrangement, the same results can be obtained by placing these vibrating screens on primary straining and at the same time considerable saving can be effected by eliminating the trash elevator.

Fig. 5 - Seven NRM 138 Vibrating Screens
Handling Hot Clarified Sugar Juice at 80 Mesh

Vibrating screens have been successfully applied in many sugar mills throughout the world, for the handling of the hot clarified juices.

These vibrating screens are placed after the clarifier to remove any foreign matter which may be carried through the clarifier.

Vibrating screens are normally equipped with an 80 mesh screen cloth and have a capacity of approximately 250 gallons per minute.

SUGAR CANE, PESTICIDES, AND WATER IN LOUISIANA

Gerald J. Lauer, Ph.D.
Principal Biologist
Pesticide Pollution Studies

U. S. Department of Health, Education, and Welfare
Public Health Service
Division of Water Supply and Pollution Control
Southeast Water Laboratory
Athens, Georgia

Introduction*

Approximately 300,000 acres of sugar cane are grown annually in 19 Parishes of Louisiana. The economic impact of this industry in the region is partially indicated by the fact that it produces an annual crop with a retail value of $120,000,000 and has a capital investment of over one-half of a billion dollars. Normally, two million dollars are spent each year on herbicides and insecticides for protection of the sugar cane crop.[1/]

In recent years endrin has been used over a wide area of south Louisiana for the control of the sugar cane borer *Diatraea saccharalis* (F.). Clay granules containing 2 per cent endrin by weight are applied by airplane to provide treatment with 0.25 pound technical endrin per acre. Four or more such applications may be made during a growing season.

Endrin is known to be highly toxic to fish and wildlife. Thirty-two fish kills were reported, primarily from the sugar cane growing area in Louisiana, in 1960. The suspected cause of most of these kills was reported to be insecticide poisoning.[5/] The kills occurred for the most part during the endrin application season. It became a matter of concern then to determine

---

* This paper is a brief, generalized summary of findings from an extensive study. For the sake of brevity, supportive data and explanatory statements relative to conclusions presented are not included. A full report of all findings is being prepared for publication.

if endrin was getting into the streams, if so what effect it was having on aquatic life, and if it persisted in water used for human consumption.

In 1961, the U. S. Public Health Service's Pesticide Pollution Studies staff, then in Atlanta, Georgia, initiated a study to obtain answers to these questions. Studies of agricultural, hydrological, water quality, and biological factors were conducted. The major study effort was directed to Bayou Yokely (a drainage basin study) and Bayou Teche near Franklin, Louisiana and to Little Bayou Black near Houma, Louisiana, in that order. Study of Bayou Teche, the source of Franklin's municipal water supply, and Little Bayou Black, the source for an industrial water supply were in the nature of stream monitoring rather than basin studies.

Investigations were also conducted at sites of three fish kills during or soon after the kills occurred. Arrangements had been made to have all kills that occurred in the vicinity reported to the investigator. However, most kills were not reported in time to permit successful sampling for the presence of pesticides.

Methods

Details of all methods will not be presented here. Numerous individuals and governmental agencies provided cooperation and assistance vital to the completion of the studies. Sugar cane growers in the Bayou Yokely drainage area contributed endrin usage information as well as rainfall data.

Sampling of streams for the presence of endrin was done by the carbon adsorption method.[4/] Laboratory evaluation of this method indicated that estimates of endrin concentrations in the streams based on it must be considered minimal.

Analyses for endrin were made by microcoulometric gas chromatography.[2/] Concentrations in water of 1 part per trillion and above were detectable by this method when used in conjunction with the carbon adsorption method.

Results

The 7,500-acre Bayou Yokely drainage basin contained 3,313 acres of sugar cane in 1961. Endrin applications were made from June 30 through August 17, 1961, amounting to a total of 1,959 pounds technical.

Observations and samplings were made in the Bayou Yokely drainages as well as other locations to determine the extent of direct contamination of streams during the aerial applications. Sampling was done with pans used by the U. S. Department of Agriculture for uniformity of insecticide application studies. In no case was endrin observed falling in the water during the applications or found in the pans afterwards.

Detectable quantities of endrin were recovered from Bayou Yokely during the period from July 8 through October 5, 1961. Recovery of endrin was related to usage patterns and rainfall. The highest concentrations were recovered from samples taken following periods of maximum endrin application when there were rains of sufficient intensity to produce abundant surface runoff. All endrin recoveries from the water were in the range from 1 to 360 parts per trillion (Table 1).

Three composited mud samples collected from the bottom of Bayou Yokely 8, 39, and 81 days (November 7, 1961) respectively after the last application of endrin were analyzed. None of these samples contained detectable quantities (10 parts per billion or more from soil) of endrin. This was also true of comparable samples taken from Bayou Teche. Composited soil samples collected from fields of the Bayou Yokely drainage on the same days contained 0.72 ppm, 0.26 and 0.20 ppm respectively. Thus, the soil still contained 0.20 ppm of endrin as long as 81 days after the last application while the water contained no detectable concentration on that date or during the month preceding it. There were no surface runoff producing rains during that month.

Carbon adsorption sampling of Bayou Yokely was discontinued on November 7, 1961. However, it was continued in Bayou Teche and Little Bayou Black into May of 1962. Water samples positive for endrin were collected from Bayou Teche as late as November 27, 1961, and from Little Bayou Black through May 10, 1962, when sampling was stopped.

Endrin was detected in the low (1-35) parts per trillion range in the raw (Bayou Tech) and finished water (2-23 ppt) of the City of Franklin, Louisiana water supply. The Franklin Water plant uses lime-alum coagulation, 1 to 2 ppm activated carbon treatment for taste and odor control, sedimentation, sand filtration, pH-alkalinity-hardness control, and chlorination.

Endrin was also recovered from both the raw (Little Bayou Black) and finished water of a Houma, Louisiana sugar refinery (Table 1).

Pesticides other than endrin (BHC, DDT, and dieldrin) were also recovered from the water of one or another of the three streams mentioned above (Bayou Yokely, Bayou Teche and Little Bayou Black). These are used for purposes other than sugar cane agriculture and, therefore, are not discussed in this paper.

Carbon adsorption samples of water were taken at sites of fish kills soon after they had occurred in borrow pits north of Centerville, Louisiana and in Bayou L'Onion north of Chegby, Louisiana, and while a kill was in progress in the Franklin, Louisiana canal. Endrin recoveries were 26 parts per trillion (ppt), 9 ppt and 40 ppt respectively. No other pesticides were recovered at these sites. Application of endrin to fields adjacent to the stream followed by rain and runoff from those fields within hours preceding the onset of fish mortality strongly suggested that endrin contamination was the cause. Other water quality measurements (dissolved oxygen, pH, etc.) made during the time the carbon adsorption sample was being collected indicated conditions suitable for fish. No kills occurred in regions of the stream not receiving the surface

runoff from the endrin-treated field. The endrin concentration recovered at each site was less than what would normally be expected to kill fish, based on data obtained from static bioassay studies which indicate a 96-hour TL_m for bluegills of 0.6 ppb.[3/] However, results of static bioassays of various concentrations of pesticides are not always indicative of what will occur in natural situations. Also, the fact that the carbon adsorption method does not provide a measure either of the actual concentrations of endrin to which the fish were subjected or the duration of exposure, should be kept in mind here as should the fact that there are environmental factors such as temperature, turbidity, dissolved oxygen content, and pH that may affect response to toxicity.

Conclusions

Endrin applied to sugar cane fields was found to enter the neighboring streams in surface runoff. Direct contamination was not found to be an important source of endrin in streams in the area studied. Endrin concentrations (minimal estimates because they are based on the carbon adsorption method of sampling) in the streams ranged from negative to 360 parts per trillion.

The treatment procedures of two water plants resulted in no apparent removal of endrin at the concentrations observed.

Soil from the Bayou Yokely drainage area was found to contain 0.20 ppm endrin 81 days after the last application was made at which time sampling was stopped.

Endrin was recovered from sites of three fish kills and all available evidence indicates that it was responsible for the kills.

TABLE I

ENDRIN RECOVERIES[1] FROM STREAMS IN SOUTH LOUISIANA

Stream and Station	No. of Samples Collected	Positive for Endrin [2]	Concentrations in Positive Samples (Parts per Trillion) Mean	Range
Bayou Yokely [3]	18	6	101	1 - 360
Franklin, La. City Water				
Bayou Teche	22	7	7	1 - 35
Holding Reservoir	21	5	3	1 - 12
Finished Water	21	2	11	2 - 23
Little Bayou Black				
Raw Water	13	4	2	1 - 4
Finished Water	14	10	5	1 - 25

1/ Recoveries by carbon adsorption method.

2/ Analyses by microcoulometric gas chromatography.

3/ Bayou Yokely water was sampled for pesticides from April through November 7, 1961; Bayou Tech and Little Bayou Black from mid-May 1961 through May of 1962.

Bibliography

1/ Anon. Louisiana Sugar. Louisiana Sugar Educational Committee. Knapp Hall, L.S.U., Baton Rouge, La.

2/ Cassil, C. C. 1962. Pesticide residue analysis by microcoulometric gas chromatography. Residue Reviews. Acad. Press Inc. H.Y.I. pp. 37-65.

3/ Henderson, C., Q. H. Pickering, and C. M. Tarzwell. 1959. Relative toxicity of ten chlorinated hydrocarbon insecticides to four species of fish. Trans. Amer. Fish. Soc. 88:1. 23-32.

4/ Middleton, F. M., A. E. Greenberg, and G. F. Lee. 1962. Tentative method for carbon chloroform extract (CCE) in water. Jour. Amer. Water Wks. Assoc., 54,2. 223-227.

5/ U.S.P.H.S. 1960-1962. Pollution-caused fish kills. DHEW, PHS Pub. No. 847; 1960 Ed. 21 pp.; 1961 Ed. 20 pp.; 1962 Ed. 21 pp.

CANE HANDLING AT GLADES SUGAR HOUSE

P. M. McIntyre, Agricultural Manager
Glades Sugar House, Belle Glades, Florida

Our system of cane handling may not be the most unique in the world, but we are the only ones in Florida delivering our entire tonnage to the factory over state highways, which last season represented approximately 900,000 miles. Up to this time, we have been the only ones using completely portable transfer stations. The steel ramp idea coming from observations made of a type used in some of the oil fields here in Louisiana.

Except for the cutting of cane, which is done by hand, the entire operation is thoroughly mechanized starting with the field pickup and continuing on to the mill carrier.

To begin with, all fields are burned before harvesting, and when cut, the cane is placed in pile rows, four single rows placed across the two center rows. If the stalks are over eight feet in length after topping, they are cut in half to insure proper pickup by the loader which has a ten foot wide conveyor.

Glades Sugar House, a fifty-three member Cooperative, owns all of the harvesting equipment and rents it to the grower members on an operating hourly basis. All rates are designed for the purpose of paying off all operating and maintenance costs, plus taxes and depreciation. Highway hauling units, truck-tractors and trailers, are owned by the factory, and the owning and operating costs are not chargeable directly to the members.

In addition to equipment rental rates charged the member, he also pays for all operators and laborers used in connection with the harvesting of his cane at wage rates equivalent to, or higher than, those set by the USDA. However, the equipment hourly rental rates are established by the Cooperative and are as follows: Continuous Loader, $11; DW-6 Tractor, $6;

Cane Carts, \$.50; and Transfer Station (consisting of ramp, dumping jack and drag conveyor), \$6. We do have additional units such as bull dozers and road patrol, used primarily for road work, which are rented for \$8 an hour.

We use J & L Model R-1000 Continuous Loaders powered by Caterpillar Model D330 turbo charged diesel industrial engines with twenty-four volt electric starting systems. The propulsion unit of the loader consists of a Caterpillar 933 Traxcavator transmission, final drive and clutch. Transmission drive is with single match set of special duty "C" section vee belts. Hydraulic drives of a commercial pump and Hydreco motors and pump operate the conveyors.

The loader is mounted on tracks using 28 inch shoes and has an overall length of 15 feet 10 inches and width of 12 feet (with exception of 30° loading conveyor). Pickup conveyor is supported on rubber tired guage wheels and is raised or lowered hydraulically.

At the top of the pickup conveyor there are five 42 inch diameter saws spaced 20 inches apart that the cane passes through as it falls onto the cross conveyor. Each saw has 34 insert point cut-off teeth which are removable and can be readily changed when necessary.

From the cross conveyor, the cut-up cane enters the 30° conveyor where it is elevated approximately eleven feet and discharged into field carts. Field hauling is done with J & L Master Side Dump Field Carts, Model C-3000, towed in units of four by a Caterpillar DW-6 tractor. Body dimensions of the cart are: height, 5'9"; width, 8'0"; length, 12'6"; with a capacity of four to four and one-half tons of cut-up cane. One side of the body is equipped with automatic gate with pivots and actuating arms so designed that the side gate will completely open when body is tipped, thereby offering no obstruction to cane flow. Solid sheet steel is used on floor of cart

while the ends and side are lined with expanded metal secured with welding clips. Cart chassis is equipped with Neway suspension using tandem axles and Budd wheels mounted with 12:50X16 tires.

Each cart has a clevis type hitch on rear of chassis frame and a towing eye at the front, except the lead wagon which has a towing dolly. The dolly has a tongue of tubular construction with 2 inch diameter towing eye for attaching to tractor drawbar and travels on rubber tired wheels of the same dimensions as ones on the cart.

For maneuverability of equipment, the transfer station sites should have an area 150 feet by 300 feet, including roadways, with sufficient marl rock topping (approximately 2 feet) to support loaded equipment. The sites are strategically located to minimize on field tractor cane haul and at the same time have access to a suitable truck route. In the case of a large acreage grower it might require two or more transfer stations while several smaller growers can sometimes use one station jointly.

At the transfer station, the cane is discharged from the field carts and conveyed into the highway trailers by the combined use of a portable ramp, dumping jack and drag conveyor. J & L Model N-2000 portable steel ramp with heavy duty expanded metal flooring and side rails is used and when in operating position is 94'5" long by 11'0" wide by 5'6" high. Attached to the right side of ramp deck is J & L Model H-2000 cart dumping unit, and the positioned to the left side of ramp deck is J & L Model N-3000 portable drag conveyor which is mounted on a two axle rubber tired full four wheel trailer. A Caterpillar D311 diesel industrial engine, equipped with twenty-four volt electric starting system, is the power unit used to operate conveyor chains and the 7GPM hydraulic pump. Dumping of field carts, operating the apron and elevating the drag conveyor is all done hydraulically.

Field carts enter the ramp on a 5-1/2^{o} grade, are stopped on flat deck

to discharge cane and then exit on $9\text{-}1/2^{o}$ grade. While carts are being dumped they are held down by means of a cable hooked to the chassis with the other end anchored to dumping platform. Another cable is hooked onto cart body and threaded through sheave on head of hydraulic cylinder shaft, which when actuated, tilts basket and opens gate to discharge cane into drag conveyor. Before tilting, a shielded apron is hydraulically positioned against the cart to guide cane into the conveyor where there are four drag chains, with six inch wide wooden slats attached 32 inches apart in staggered positions, to elevate cane approximately 17-1/2 feet where it falls into highway trailer.

To make the transfer stations portable requires the use of winch trucks with fifth wheels attached. The ramps are made in two sections, entrance and exit halves, and are taken apart for traveling. Each section becomes a trailer when the dual 10:00X20 rubber tired wheels under the back end are lowered; they are on an accentric axle and are lowered by means of a cable attached to a winch on the truck. The front end has a ten foot hinged section which folds over, and just back of the hinge point is a kingpin for attaching to fifth wheel on winch truck, thereby making a complete unit of overall dimensions within highway limitations when used with a "continuing permit". The dumping unit is detached from the ramp and transported separately, and the platform to which it was attached folds over ramp section to minimize overall width.

Landing pads which are used under conveyor for stability while operating have to be jacked up and the elevator hydraulically positioned parallel to the ground before unit becomes mobile. When in this position, and with shielded apron folded over, the conveyor is only 10' wide by 11'9" high and can be towed with either winch truck or field towing unit, depending upon condition of roads and distance to be moved.

Our highway units consists of International Model BC205 truck-tractors with a 450 cubic inch engine, pulling a J & L Model A-2000 semi-trailer chassis mounted with two side dump boxes. Dimensions of each box are 8'0" wide, 8'11" high and 22'1" long with a capacity of 20,000 pounds of cut-up cane, or a payload of 20 tons. Overall dimensions of the unit are 8'0" wide, 13'6" high and 55'0" long which is the maximum allowed by Florida Law. The tare weight is approximately 31,300 pounds broken down as follows: boxes, 12,400; trailer, 10,000; and tractor, 8,900 pounds. Placement of the Neway suspension with tandem axles under the trailer carrying 10:00X20 tires and fifth wheel on tractor, so distributes the weight on all axles that the "bridge formula" of the state of Florida is complied with. However, improper loading can invoke a penalty for overweight on any one axle.

Boxes on the trailer are fabricated of the same type material as those on field carts, having automatic gate with pivots and actuating arms so designed that gate will completely open when box is tipped for unloading without offering obstruction to cane flow.

Our cane acreage is spread over a thirty mile radius, the majority being within twelve miles, and is divided into four zones. All zones are harvested simultaneously with the schedule so arranged that long, medium and short distance hauls are included in each days' cane delivery. This is done to avoid a shortage or surplus of highway hauling equipment which could occur if too much tonnage was required from either long or short distance hauls on any given day. For the 1963-64 crop, our average highway hauling cost per ton of cane was 55 cents, including taxes and depreciation.

Due to the wide area over which our cane is planted, the field equipment is not operated from a central point as the highway units are. Each zone has its own block of equipment to harvest the tonnage required by the schedule

and transfers its equipment from grower to grower by using its own facilities. Only exception being the continuous loader which is usually transported over the highway by low-boy but requires a special permit due to its over-width.

Since operating cost figures are not available at this time, I can only quote capacity figures for the various types of equipment as experienced during our 1963-64 harvest. Field layout, variety of cane, tons per acre and condition of haul roads all play a part in production. However, the average tons of cane handled per operating hour are as follows: Continuous Loader, 100 tons; Drag Conveyor, 175 tons; and DW-6 Tractor, with four cart train, 33 tons.

Based on the equipment rental rates mentioned earlier, our cost per ton of cane were: loading, 11¢; field hauling, 25¢; and transferring, 3¢; or a total of 39¢ from field onto highway trailers. This, of course, does not include any labor costs.

The matter of cane handling passes from agriculture to the sugar house at our scales. This is a small concrete block structure with an 80,000 pound capacity Fairbanks-Morse platform scale on each side. Since our system calls for tare weighing the hauling units after each delivery, it is obvious that unless we have two scales the traffic jam would be terrific when attempting to haul 7,500 tons in eleven hours with an average payload of 19 tons per truck.

The pit in which the cane is dumped covers an area 420 feet by 80 feet with concrete floor and walls, serviced by two high speed P & H bridge cranes. These cranes have a bridge speed of 450 FPM, which makes it possible to move the high tonnages we require. A good operator can feed the mill out of the pit with one crane provided the grinding rate does not exceed 6,000 tpd. This, to a great extent, is a function

of the weight of cane picked up by the grapples, which are physically about as large as can be handled, weighing over six tons and can pick up approximately three and one-half tons of the cut-up cane.

The cranes are each equipped with three 100HP motors and one 25HP. The big motors respectively move the bridge, and close and open the grapple, while the 25HP moves the carriage. The controls of the cranes are all electrical, and though not highly complicated, must have routine maintenance checks by a competent electrician. The brake shoes are the items that require the most attention; their life depends to a great extent on the competence of the operator, but will not last more than a week in the case of the bridge, and longer in the course of the other functions. We have found it expedient to change all brake shoes at fixed intervals whether they need it or not.

Instructions for dumping the truck begins at the scale-house where the driver is told which ramp to go on for unloading. For "Storage" he goes up the ramp at the edge of the pit and stops at one of the two stations. Upon stopping, a hydraulically controlled apron is positioned against left side of trailer chassis to guide cane into pit. Then four hydraulic cylinders rise vertically through ramp floor to support trailer chassis along left hand outside channel, spacing two underneath each box. On opposite side of trailer, two hydraulic cylinders have their swinging spreader bars attached to each box, tilting same to discharge cane into pit.

For "Direct" dumping to the mill, the truck proceeds up the other ramp where there are two stations identical with those on the "Storage" ramp, but dumping into a cross-carrier which feeds the main mill carrier. Only one station is used at a time, the other being a spare for use in the event of any mechanical failures.

When the cane is dumped for storage the overhead cranes, with grapples have to continually transfer it into a stockpile in the pit for night grinding. During the night the cranes feed the mill by transferring cane from the stockpile to two feed tables, each 20'X30' in size. The feed tables and two auxiliary carriers are operated from a control tower located so as to give the operator a "bird's eye view" of the units under his control. He operates the feed tables with wound rotor motors and the carriers with Gyrol hydraulic drives located between the motors and the speed reducers. The feed tables, in turn, dump into a carrier which is in line with, and feeds into, the main mill carrier. To avoid a build-up of old cane in the pit, alternate ends are cleaned thoroughly each day. A rubber tired machine, similar to a pay-loader, with a special push type bucket mounted in front keeps cane "rounded-up" so grapples can handle it.

The side walls of the pit are 13 feet high and the bridge crane grapples operate at a height of 31 feet above pit floor. This, with the 33,600 square foot floor area, gives a storage capacity of approximately 5,000 tons of cane which is ample for night grinding with some surplus in event the trucks are delayed in starting the following morning.

Beginning with the weighmaster on through to the cane pit cleanup man it requires a personnel crew of 24 for the twenty-four hour operation. Our labor cost for last season was just over eight cents per ton of cane.

ECONOMIC AND OTHER ADVANTAGES OF INCREASING MILL CAPACITY

M. J. McNulty
THE SOUTH COAST CORPORATION, OAKLAWN DIVISION
Franklin, Louisiana

The large increase of production in sugar cane that has taken place in Louisiana over the last few years has naturally created doubts as to the ability of the existing factories to handle all of the available cane. This has brought, as a consequence, a demand for the construction of new mills and two mills are at present under construction; one in the Loreauville area, a cooperative; and a privately financed mill at Reserve, though it, too, will receive federal aid. There is also talk of another new mill for 1965 in Plaquemines Parish below New Orleans. The Loreauville and Reserve mills expect to obtain their cane supply partly from established areas and partly from new plantings.

A discussion of this situation took place in the Louisiana Sugar Producer's Club, Western Division, at meetings of this organization in 1962 and again in 1963. As a result of these discussions the Club conducted surveys in the spring of 1962 and 1963 of the expected increase in grinding rates for the individual factories in the St. Mary, Iberia, St. Martin, Vermilion and Lafayette Parishes.

The fifteen factories included in the 1963 survey estimated a 15% capacity increase for 1963 over 1962. A check of actual grinding of these same fifteen factories in late November of 1963 showed that up to that time these factories had ground at almost 19% greater capacity than in the previous year. The processors in this area had always assured the cane producers that if the cane was there the factories would have the necessary capacity to grind it if the producers made orderly deliveries to the mills so that no time was lost for lack of cane. This belief has

been justified as very little cane was lost due to the hard freeze in early December and, if growers had utilized all mill outlets, no cane would have been lost in the Western area. Planned increases in capacity in these existing mills for 1964 is 34% more than in 1962.

The writer has believed, and has so stated on several occasions at meetings of the Producer's Club, that the existing factories could handle much more cane than they ground in 1962, and that it was imperative that something be done to achieve this goal. Some of the fifteen factories made major improvements in their plants, but most of the mills made changes of a minor nature which did not involve heavy outlays of cash.

The cost of construction of a new sugar mill at this time runs somewhere near $2000 per ton of daily grinding capacity. Only a few years ago this figure was $500 to $700 per ton. The return which can be expected from a new sugar factory in Louisiana under normal conditions of supply and demand, and under conditions that limit the length of the grinding season, does not make an investment in a new factory too attractive. Only a cooperative mill which can obtain money for construction and working capital at low interest rates and under highly favorable tax conditions and can assess members for losses can have a chance for survival.

It is therefore necessary that the existing factories find ways to expand their milling capacity. We should, then, carefully consider the factors affecting the expansion of existing mills and determine what can be done to achieve this goal. These factors will not be identical in all factories for each mill will have its individual bottleneck.

The simplest way in which a factory can increase capacity and one which involves no expenditure of capital is to start the grinding season as early as cane maturities will permit. A small loss in revenue to growers incurred in slightly below standard cane is a small insurance premium to pay in order

to eliminate the peril of very costly losses in above standard cane at the end of the season due to freeze damage.

Carefully planned delivery schedules can obviate much lost time. Only a catastrophe is justification for lost time due to lack of cane.

Let us consider the direct economic benefits to be derived through the expansion of capacity of the existing mills. We will take for this purpose the case of a mill whose average daily grinding capacity was 3200 tons in 1962. By the addition of heating surface to the existing evaporator at a cost of approximately $200,000, the average daily grinding capacity was raised to 3800 tons in 1963. This was a net gain of 600 tons of cane per day that was ground without the expenditure of one single extra dollar in labor. The only increased cost due to this increased capacity was the insignificant cost of lime. Raw sugar was produced and shipped in bulk.

The actual cash return to the mill due to this increase in capacity was the difference between the value of the sugar and molasses produced less the cost of cane plus loading and hauling. The average price of 96^{o} polarization sugar was 8.9952 cents per pound and the cost of a standard ton of cane, including hauling and loading was $10.39. The average price of molasses for the season was 18.6008 cents of which the producer recovered 41.583 cents per standard ton. At 6 gallons per ton the total value of molasses was $1.116. This left 70 cents per ton as the processor's share. Since 175 pounds of 96^{o} sugar were recovered per ton of standard cane the value of the sugar produced was $15.7416 and value of sugar and molasses was $16.4416. This amount less the $10.39 value of cane amounted to $6.05. This was the actual cash value to the processor of each of the 600 tons increase. The cash value of this increase on a 75 day crop amounted to 600 x 6.05 x 75 or $272,250. This amount, less 52% federal income tax, paid for almost two-thirds of the evaporator cost.

It has been the writer's experience that the grinding rates of most existing mill tandems in Louisiana <u>can</u> be stepped up without sacrificing efficiency. There are many ways in which this can be accomplished and only by a careful survey by a competent engineer can the best and most economical way to do this be determined. Generally, however, by paying careful attention to the following items most mills can grind more cane:

1. Constant cane supply to mill.
2. Delivery of fresh, clean cane reasonably free of trash and dirt.
3. Good preparation of cane by rotary knives.
4. Steady, even feed to the crusher or shredder.
5. Adequately designed mill settings to handle the desired amount of cane.
6. Free moving rams in hydraulic caps.
7. Large, sharp peripheral and lateral grooving.
8. Adequate peripheral speed of rolls in order to generate desired circumscribed volume.
9. Maintenance of equal or nearly equal diameter of rolls in mill.
10. Well designed feed rolls on each mill.
11. Complete maintenance of each piece of equipment from stacking and feeding equipment in yard to loading and shipping equipment for sugar and molasses. This is possibly the most important work to be done as upon the condition of the equipment rests its performance during grinding season. It has been said that a successful grinding is made in the Dead Season.

In the case of those factories that are obliged to burn bagasse the boiler capacity is more than adequate for present grinding rates and will allow expansion. Those factories that use natural gas for fuel and bale their bagasse for sale do not find themselves in this comfortable situation.

They are not faced with the problem of consuming the bagasse from high-fiber canes in the boiler furnaces - and it must be consumed or the alternative of hauling it away is faced. These plants in most instances would require an increase in steam generating equipment in order to increase capacity.

From casual observation it would appear that most Louisiana factories have ample juice heater capacity for present grinding rates with sufficient extra capacity for some increase. Juice pumps, maceration pumps and cush-cush screening capacity are in the same category. Even in cases where this latter equipment is not sufficient for capacity expansion the cost is relatively low and would pose no great cash outlay.

One of the main problems encountered in striving for greater grinding capacity is the clarifiers. At times during periods of rainy weather an excess of clarifier capacity and filter capacity can quickly convert itself to a shortage due to field mud entering the factory with the cane. All of the factories, however, now have some kind of cane washing equipment which is placed in use during these wet periods. Some factories wash cane continuously.

A very common bottleneck in many factories is a tight evaporator and vacuum pan station. In some cases capacity evaporation cannot be obtained due to a lack of sufficient condensing water. This situation is most apparent as the beginning of the grinding season when ambient temperature is in the range of 90^{o} - 100^{o}F. Inadequate vacuum pumps of insufficient capacity to remove incondensible gases can mean a sharp drop in evaporative capacity. Fortunately, inexpensive steam jet evacuators are on the market.

In cases where calculations of heat balance show a shortage of heating surface in the evaporators, one solution - the most economical - is the installation of a single body vapor cell or pre-evaporator, depending on

quantity of exhaust steam available. A single body of sufficient heating surface in this way can be an alternative to a complete evaporator change-over.

The writer has found in many instances that a bottleneck in the vacuum pans was not really due to a lack of sufficient equipment but to the time consumed in dropping strikes and raising vacuum and to a lack of seed when needed. In the case of C sugar pans in particular a great deal of unnecessary delay is incurred through dropping strikes through small piping or troughs to distant crystallizers. Here, too, attention should be given to obtaining sufficient water for condensers and to raising vacuum in a minimum amount of time.

Careful planning and forethought is necessary for efficient vacuum pan operation. Much valuable time can be lost waiting for footings or for a mixer in which to drop the strike. There should be an adequate supply of footings at all times contained in seed recipients for A and C strikes. Good sugar boiling is highly important as this can cause a loss of pan capacity. Cleaning up a smeared strike not only uses up time but also consumes steam for no useful purpose.

Another station which tends to limit capacity in many factories is the centrifugals. This condition can be alleviated by changing the size of the baskets from the standard 40 inch x 24 inch size to the 40 x 30. This entails dropping the platform six inches, increasing the height of the curbs and the length of the spindles. Stepping up the power of the centrifugal power source may also be necessary. Sometimes this can be accomplished by the installation of larger nozzles if the power source is a steam turbine. The increase in depth of basket produces an increase in capacity of 25%.

Capacity of centrifugals may also be increased by installing new units of standard or continuous centrifugals at relatively reasonable cost in

relation to value of increased capacity. Several Louisiana mills have tried out continuous centrifugals of various manufacturers and all have reported that operation is satisfactory on low grade sugars but that wear on screens is excessive.

Besides the economic advantage of increasing grinding capacity there is also the feeling of security which both processor and producer feel when they know that the cane can be ground in a reasonable time. The specter of early freezes is something we all have to live with and the value of the crop involved makes it mandatory that the factories increase their capacity along with the increase in cane supply. If existing mills do not do this then new factories will be built. When we go back to quotas, as we all know is inevitable, then all factories will be cut back to the point, perhaps, where making a profit will be difficult if not impossible.

A PROPOSED STANDARD RUN REPORT FORM AND SOME COMPARATIVE COMMENTS ON THE 1963 FACTORY OPERATIONS

John J. Seip
Chemical Engineering Department
Louisiana State University

SECTION I

INTRODUCTION

During the last June meeting of the ASSCT, some discussion centered on the desireability of establishing uniform factory control in Louisiana to include:

1. Standard factory control reports.
2. Uniform methods of sample analyses.

Among the long range objectives of this program were the desireability of providing:

1. Ease of preparation and interpretation of factory control reports.
2. Ease of training laboratory personnel.

As a first step, it was suggested that initial efforts be directed toward preparing a run report form which could be generally used in the industry.

Subsequent to the June meeting, a rather comprehensive questionnaire was sent to all factories. This questionnaire titled "Synopsis of 1963 Factory Data", covered final run data and associated operating data. The purpose of this questionnaire was to determine what data might be expected to appear in a complete run report, and what data might be particularly meaningful. Concurrently, the factories were requested to send copies of control reports presently in use.

In this presentation, the following material is covered:

1. A summary review of the 1963 factory synopses.
2. A proposed standard run report form.
3. A proposed glossary of terms generally used in the Louisiana raw sugar industry.

PART I - COMMENTS ON THE 1963 FACTORY SYNOPSES

The data provided in the factory synopses were used for several studies covering the 1963 crop. This discussion will be limited to a comparison of certain aspects of factory performance. Particularly of interest are those aspects which lend themselves to r eady and reliable use as indeces of factory performance.

Indeces of factory performance are in effect measures by which we judge the results of the factory operation. Such indeces may be quantitative as tons cane per crop - or tons per day.[1] Such quantitative data may be meaningful to an individual factory as they compare today's operations with those of yesterday - or with those of last crop at this time. For purposes of comparison among different factories they may be meaningless unless other qualifying factors are considered - as milling equipment or cane quality.

The above discussion leads to another index of factory performance - performance criteria. Performance criteria may be defined as figures which have been devised to measure the merits of the results achieved.[2] Such measurement may be in terms of a theoretically optimum value as boiling house efficiency which compares actual with a theoretical retention as predicted from one of the retention formulas. In this sense, pol extraction is a criteria of milling performance if we consider 100 to be a theoretically attainable extration. Other performance criteria - instead of expressing results in terms of a theoretically optimum figure - may be in terms of qualifying considerations as load rate which expresses milling rate in terms of fiber in cane and the surface area of the mill rolls. Some quantitative

---

[1] Laboratory Manual for Queensland Sugar Mills, Fourth Edition, Division of Mill Technology, 1961, p. 141.

[2] Ibid., p. 141.

indeces of factory performance are used as performance criteria. For example, purity drop, crusher to last expressed juice is sometimes used in Louisiana to compare performance among factories. This term considers no qualifications as milling equipment or cane quality.

Criteria of Milling Performance:

The following criteria of milling performance were investigated:

Pol Extraction: Pol in mixed juice percent pol in cane.

Milling Loss: The percentage ratio of pol in bagasses to fiber in bagasse.

Absolute Juice in Bagasse Percent Fiber: By definition -

$$\frac{(100 - \text{Pol Extraction})\ (100 - \text{Fiber \% Cane})}{\text{Fiber \% Cane}}$$

Purity Drop, Crusher to Last Expressed Juice

Brix Drop, Crusher to Last Expressed Juice

The Ratio of Crusher Juice Pol to Bagasse Pol

The above criteria differ one from the other in several respects. In the first place, a criterion such as pol extraction, which is based on the weight of cane as well as inspections of mixed juice and bagasse, can only be determined at the end of a period of time when accurate cane weights can be determined. For the typical Louisiana factory, where the cane pile in the yard is usually liquidated at the end of a week, a meaningful pol extraction is based on a week's operation. Other criteria as milling loss, and purity or Brix drop, which are based on spot or periodic laboratory inspection, can be determined at fairly frequent intervals.

Another aspect to be considered is that a criterion as pol extraction yields data which are of direct interest. Pol extraction tells us the percentage of the pol entering the factory which is extracted in the milling tandem. In a similar vein, retention tells us the percentage of the pol

extracted which is recovered in sugar. Other criteria as milling loss, and purity and Brix drop, provide us with information from which we can infer the pol extraction.

In the case of the above criteria, absolute juice in bagasse percent fiber probably comes closest to the definition of performance criteria in that it attempts to factor extraction to a common basis - in this case fiber - to facilitate comparison among factories grinding different quality cane. Another criterion serving this same purpose is reduced extraction, which is pol extraction reduced to a common basis of 12.5 percent fiber.

In these studies, the final run data from 15 factories were correlated by a regression analysis which related pol extraction to the various other criteria of mill performance. In other words we are asking ourselves: "Since polextraction is what we are primarily interested in, how well do the other criteria correlate with it?" For these analyses, a correlation coefficient, r, was determined. An r of 1.0000 shows a perfect correlation. The lower the value of r, the poorer the correlation. The results of these studies are shown in Table 1. The correlation coefficients are summarized below and compared with the results of 30 milling tests at the Audubon Sugar Factory under varying conditions of maceration and mill speed.

Correlation with Pol Extraction

	Correlation Coefficient, r	
	15 Factories	Audubon Sugar Factory
Milling Loss	0.7135	0.7830
Absolute Juice in Bagasse % Fiber	0.4174	0.7100
Brix Drop, Crusher to L.E. Juice	0.3372	0.0232
Purity Drop, Crusher to L. E. Juice	0.2690	0.0238
Crusher Pol/Bagasse Pol	0.8175	0.0940

The rather high degree of correlation for milling loss shows that this easily calculated figure is an important criterion of mill performance. Few factories in Louisiana calculate absolute juice in bagasse

percent fiber, and it is questionable whether the time spent in such a calculation is warranted. While purity and Brix drop, crusher to last expressed juice, are easily determined, they show a poor correlation.

The ratio of crusher juice pol to bagasse pol showed the best correlation in the factory studies and the third best in the Audubon Sugar Factory investigation. The difference in order of magnitude of the r factor between the two studies indicates further work should be done regarding the value of this criterion.

In reviewing the above data the following questions came to mind: "How did the factory milling rate affect extraction?" "Would we expect the factory grinding at a high rate to have a poor extraction?" Since up to now we have considered only criteria of extraction efficiency, we will now define a criterion of milling rate as:

$$\text{Load Rate} = \frac{\text{Tons Fiber}}{\text{Hour - Square Feet of Total Roll Surface Area}}$$

The roll surface area in this case is based on all rolls in the tandem to include the crusher. This criterion considers the number of rolls in the tandem, which is not the case for a criterion such as tons fiber/hour-foot roll length.

The data in Table 2 are presented in order of decreasing pol extraction with the corresponding load rates. Considering 12 of the factories for which both pol extraction and load rate are available, it is interesting to note that as a general observation, the factories with high extraction have a high load rate as shown below:

Pol Extraction	Order of Extraction	Load Rate	Order of Load Rate
91.54	1	0.0310	3
90.69	2	0.0340	2
90.54	3	0.0270	6
90.16	4	0.0450	1

Other Factors Influencing Extraction

Cane Preparation: Of the total of 14 factories shown in Table 2, four have shredders in addition to one or two sets of knives and a two or three-roll crusher. It is interesting to note that of the first four factories in order of extraction efficiency, three have shredders.

Number of Extraction Mills: Of the same first four factories in order of extraction efficiency, one has five three-roll extraction mills, two have four three-roll mills, and one has three extraction mills. In reviewing the extraction equipment of the remaining factories, it is noted that in general, the factories with three three-roll extraction mills have a relatively low order of extraction.

Factors Influencing Milling Rate

Table 3 shows 12 factories in order of decreasing load rate. Three of the total of 12 factories have shredders, and of the four factories showing the highest load rate, two have shredders in addition to one or two sets of knives.

These brief observations on extraction and milling rate are, of course, quite limited since such factors as mill grooving, settings, and mill pressure are not considered.

A Correlation Expressing Both Extraction and Milling Rate

The recent record cane production figures in Louisiana coupled with the ever present need to complete the crop within a limited time - specifically within the limits of immature cane at the start of the crop and the possibilities of freeze damage later in the crop - have placed the concept of milling efficiency in a new light. While high extraction efficiency may be desirable it may be at the expense of milling rate. Correlations showing the interrelation of extraction efficiency with milling rate are badly

needed. Such correlations could be used to estimate:

1. For Existing Factories:

   a. What is the relative loss in extraction for a given increase in milling rate?

   b. At a given milling rate, what increase in extraction might be expected with additional roll surface area?

2. For a New Factory or Milling Tandem:

   a. What is the predicted extraction under specified conditions of milling rate and extraction equipment?

Along this vein, it is noted that as a result of recent studies at the Audubon Sugar Factory covering the milling performance of several Louisiana factories, the following correlation was proposed; which related a criteria of milling performance with four milling variables:[3]

$$Y = \frac{K\,(x_1)^{0.03}\,(x_2)^{0.06}}{(x_3)^{0.11}\,(x_4)^{0.14}}$$

where: Y is pol extraction

x_1 is pol percent cane

x_2 is maceration percent cane

x_3 is load rate, tons fiber/hour-sq. ft. roll surface area.

x_4 is fiber percent cane

K is a constant which accounts for differences in such factors as mill roll grooving, setting and pressure.

---

[3] V.P.S. Sirhoi, "Evaluation of a New Formula for Pol Extraction," M. S. Thesis Louisiana State University, 1963.

Correlations of predicted with actual performance using this equation were not sufficiently accurate to recommend its adoption. Studies are continuing, and the results of fundamental milling investigations at the Queensland (Australia) University may throw considerable light on what milling variables _are_ critical in such a correlation.

Criteria of Boiling House Performance

Before closing this phase of the discussion it is desired to make a few comments relative to the factory study as regards boiling house performance.

While available criteria for evaluating milling performance may leave something to be desired, the situation here is far more satisfactory than that of evaluating boiling house performance. In Louisiana, the comparison and prediction of boiling house performance is strictly empirical when one considers such factors as immature cane at the start of the crop, stale and trashy cane throughout the crop as a result of mechanical harvesting and loading, and freeze damaged cane at the latter stages of the crop. The reason for this situation is evident when one considers that boiling house performance is judged on the basis of theoretical formulas which were originally developed on the basis of fresh, clean, and hand-harvested cane.

Many criteria for boiling house performance are in use covering the _overall_ operation such as boiling house efficiency, and the _individual_ clarification, filtration, pan, and crystallizer _stations_ as purity drop-mixed juice to syrup, pol percent filter cake, and purity drop-syrup to final molasses.

The following two criteria of boiling house performance are considered here:

Boiling House Efficiency: The percentage relation between the actual retention and the theoretical retention.

Purity Drop, Syrup to Final Molasses

Boiling house efficiency, like pol extraction, is determined from factory weights and measures as well as products inspections, and for this reason can be determined only at the end of a period of time - usually a run. By contrast, purity drop, syrup to final molasses, can be calculated from periodic laboratory inspections. The data from 16 factories are shown in Table 4. The correlation coefficient relating purity drop, syrup to final molasses, to boiling house efficiency is 0.6645. A perfect correlation is, of course, 1.0000.

Similar correlations were run relating purity drop, third massecuite to final molasses, with (1) third massecuite Brix, (2) crystallizer capacity, and (3) centrifugal capacity. The correlations were generally poor with the best being that of centrifugal capacity with a correlation coefficient of 0.3055.

As regards boiling house performance, this discussion has merely scratched the surface. Many factors enter into such an evaluation. Only limited industry data are available on the reducing sugar (R.S.) ratio over the clarifier station as an indication of inversion. A similar situation exists with regard to R.S.-Ash ratio as a criterion of the potential molasses exhaustion in the different areas of the state.

PART 2 - THE MANUFACTURING (RUN) REPORT

General

A brief comment might be in order regarding the terminology of the various factory control reports which are used in Louisiana. The term "Manufacturing Report" or "Weekly Manufacturing Report" includes those control reports which cover a period of factory operation, i.e., a run. The run is usually of a week's duration, although it may be bi-weekly

or longer. By contrast the term generally used for <u>daily</u> control reports is "Daily Operating Report". For simplification, the term "Run Report" is suggested in preference to Manufacturing Report. The connotation of the term in this context should be quite clear.

The contents of the run report are obviously a function of the purpose of the report. Among other things, the run report should be:

1. A means of comparing current factory performance with that of preceeding runs or with that of the same period in a preceeding crop.
2. A means of comparing the current factory operation with that of other factories.

Comparison of factory performance implies that there are <u>indeces of factory performance</u> which provide a meaningful measure of the factory operations. In the preceeding section, the following index of performance classifications were suggested.

<u>Quantitative Data:</u> The <u>quantities</u> of material entering in, passing through, or leaving the process; the <u>composition</u> of raw material, intermittent and final products; and the <u>conditions</u> under which the various processing stages are conducted. Such quantitative data may be directly determined, as tons of cane ground, or they may be <u>derived</u> from direct determinations as maceration percent cane as determined from the weight of the cane and maceration water.

<u>Performance Criteria</u>: Figures which have been devised to to judge the merits of the results achieved. Such criteria may be based on theoretically optimum values as boiling house efficiency, or they may be expressed in terms of equipment or cane quality qualifications as load rate in tons fiber/hour-square foot of roll surface area.

Admittedly, the distinction between quantitative data and performance criteria may be vague in certain instances. Pol extraction as compared to an optimum extraction of 100 can be considered as a criterion of milling performance. On the other hand, with no qualification as to the fiber content of the cane-or the milling equipment available-it might be considered a quantitative index only.

For simplicity, the following basic considerations enter into a control report.

1. Contents of the Report
2. Terms Used
3. Organization of the Report

As regards the run report, the contents, terms used, and organization of the reports vary considerably from factory to factory.

Contents of the Report

Ideally, the run report should be sufficiently complete so that a minimum of other reference material is needed to supplement the run information. This consideration is particularly important as it becomes necessary to refer to operations several years back.

The following major classifications of run report information are suggested based on current Louisiana practice:

1. Operating Data: General quantitative data and performance criteria relating to the milling and boiling house performance.
2. Production Data: Quantitative data relating to the sugar and molasses produced.
3. Analyses: Inspections of the raw materials, intermediate streams, and final products.
4. Pol Balance: A material balance around the factory, specifically

covering pol, and based on quantitative data (from weights and measures) and inspections of the factory streams.

5. Supplies Used: Chemicals and fuel used in the process.

6. Products Shipped: The account of sugar and molasses shipped and in inventory.

7. Lost Time: Factory production time lost due to mechanical failure at various stations in the factory, and to other reasons.

8. Miscellaneous and/or Remarks: Additional information which may be necessary to describe the run, or data which may be necessary to qualify entries in preceeding sections.

Unfortunately, the distinction among the major classification in practice is not as neat as would be desired.

Terms Used in the Control Reports

There is an obvious need to standardize both the terms used in the Louisiana control reports as well as the interpretation of the terms.

Usage and interpretation of the terms varies not only within the Louisiana industry, but local practices are at variance with those on an international scale. A tidying up of this situation should be geared to (1) standardize the local usage and (2) wherever possible bring local practice into conformity with that recommended by the ISSCT Special Committee on Uniformity in Reporting Factory Data.

With the above idea in mind, the appended material titled "Definitions for Raw Sugar Factory Control in Louisiana" has been prepared.

Actually, no drastic revision of present practice is suggested. As noted in the cover page to the section, substitution of pol for sucrose is proposed where the direct polarization is used. An exception is sucrose percent normal juice where general usage of this term for cane payment

purposes suggests the adviseability of retaining the term in this context.

Some changes are proposed to bring local practice into conformity with that recommended by the ISSCT as mixed juice for dilute juice, last expressed juice for last roll juice, reducing sugars (R.S.) for glucose, purity rather than apparent purity, and true purity, to define percent sucrose in Brix.

Several standard sugars which are used on a local and international basis are discussed to include raw value, 96° sugar, and equivalent standard granulated sugar, E.S.G. Considerable confusion still exists locally in the comparison of factory reports, for some factories use 96° sugar while others use raw value. It is suggested that raw value be adopted, since this term is of necessity used in reports under the Sugar Act.

Organization of the Run Report

It would admittedly be desirable to design a run report adapted to a single standard 8-1/2 in. x 11 in. sheet. If the report is to provide a maximum of critical data, requiring minimum reference to auxiliary reports, this appears to be an impossibility.

Appended to this presentation is a suggested run report form. The report is 11 in. x about 18 in. It is evident in retrospect that the long dimensions can be reduced to 16 in. by eliminating the remarks section and using for this purpose existing space within the report. With the 11 in. x 16 in. dimensions, a single fold will permit the form to be filed in a standard 8-1/2 in. x 11 in. binder.

Final Remarks

Work will continue on correlating factory operating data and that of the Audubon Sugar Factory to determine which criteria of factory performance are meaningful.

It is urged that you review the section on "Definitions" and let me have your thoughts on the suggested nomenclature and definitions. In the same vein, comments are solicitated on the proposed run report form.

While it would be desirable to submit along with this suggested run report form, recommendations to include the daily operating report and the various work sheets - as well as a laboratory manual for Louisiana raw sugar factories - this is not possible. The proposed run report is a step along the road to standardization of the control reports, and the "Definitions" are a part of an ultimate laboratory manual.

TABLE 1

MILLING PERFORMANCE CRITERIA-EXTRACTION

Factory	Pol Extraction	Milling Loss	Absolute Juice in Bagasse % Fiber	Purity drop, Crusher to Last Roll	Brix Drop, Crusher to Last Roll	Crusher Pol/ Bagasse Pol
SW 5	91.54	6.90	56.53	9.13	12.65	4.693
SE 14	91.04	7.07	58.87	8.71	11.13	4.210
SW 1	90.69	6.85	54.59	6.92	11.32	4.552
SE 16	90.54	6.91	55.16	7.48	13.18	4.498
SE 13	90.16	7.39	60.11	6.30	8.09	3.880
SE 17	90.00	7.55	51.58	5.61	10.96	3.987
SW 11	89.90	7.50	55.79	6.53	10.58	3.997
N 11	89.79	7.22	54.33	3.27	11.18	3.943
SE 8	89.64	7.73	68.92	9.94	11.83	4.093
SE 18	89.48	8.12	65.71	6.47	10.79	3.684
SE 7	89.38	7.29	61.85	9.84	8.72	3.869
SE 11	89.06	8.23	71.13	4.45	9.80	3.431
SE 2	88.35	7.52	63.03	8.92	12.50	3.893
N 9	88.19	7.34	64.52	----	----	----
SW 9	87.71	8.69	57.10	5.00	9.72	3.498
Correlation Coefficient, r		0.7135	0.4174	0.269	0.3372	0.8175

TABLE 2

FACTORS INFLUENCING MILL EXTRACTION

Factory	Pol Extraction	Cane Preparation[1]	Number of 3-Roll Extraction Mills	Load Rate, Tons Fiber/ hr-sq. ft. roll surface
SW 5	91.54	2K-1S-3R	5	0.0310
SW 1	90.69	1K-2R	4	0.0340
SE 16	90.54	2K-1S-2R	4	0.0270
SE 13	90.16	1K-1S-3R	3	0.0450
SE 17	90.00	1K-2R	4	0.0200
SW 11	89.90	1K-2R	4	0.0270
N 11	89.79	2K-3R	4	0.0250
SE 8	89.64	2K-2R	5	0.0260
SE 18	89.48	1K-2R	3	0.0180
SE 7	89.38	2K-2R	4	0.0290
SE 11	89.06	2K-2R	5	0.0278
SE 2	88.35	1K-3R	3	0.0120
N 9	88.19	1K-1S-2R	3	------
SW 9	87.71	2K-2R	4	------

[1]K=Knife Sets
S=Shredder
2R=Two Roll Crusher
3R=Three Roll Crusher

TABLE 3

FACTORS INFLUENCING MILL CAPACITY

Factory	Load Rate, Tons Fiber/ hr. - sq. ft. Roll Surface	Cane[1] Preparation
SE 13	0.0450	1K-1S-3R
SW 1	0.0340	1K-2R
SW 5	0.0310	2K-1S-3R
SE 7	0.0290	2K-2R
SE 11	0.0278	2K-2R
SE 16	0.0270	2K-1S-2R
SW 11	0.0270	1K-2R
SE 8	0.0260	2K-2R
N 11	0.0250	2K-3R
SE 17	0.0200	1K-2R
SE 18	0.0180	1K-2R
SE 2	0.0120	1K-3R

[1]K=Knife Sets
S=Shredder
2R=Two Roll Crusher
3R=Three Roll Crusher

TABLE 4

BOILING HOUSE PERFORMANCE CRITERIA

Factory	Boiling House Efficiency	Purity Drop, Syrup To Final Molasses
SW 5	100.30	50.07
SE 7	100.13	50.77
SW 9	100.05	47.58
SW 1	99.71	50.11
SE 18	99.35	51.60
SE 11	99.18	51.32
SE 8	99.06	51.33
SE 17	99.01	49.70
SE 14	98.82	48.58
SE 3	98.69	50.01
N 9	98.32	43.63
SW 11	97.95	49.59
SE 2	97.41	46.33
SE 13	96.00	47.62
N 11	95.47	42.21
SE 16	94.81	46.27
Correlation Coefficient, r		0.6645

FACTORY

practices

a more

ation of

l Committee

Society of

ndustry.

nfusion,

y of

SSCT.

s identi-

ition are

n.

e of the

zation of

s sucrose.

ion method.

e term

General

viseability

rence to

reference

TABLE 4

BOILING HOUSE PERFORMANCE CRITERIA

Factory	Boiling House Efficiency	Purity Drop, Syrup To Final Molasses
SW 5	100.30	50.07
SE 7	100.13	50.77
SW 9	100.05	47.58
SW 1	99.71	50.11
SE 18	99.35	51.60
SE 11	99.18	51.32
SE 8	99.06	51.33
SE 17	99.01	49.70
SE 14	98.82	48.58
SE 3	98.69	50.01
N 9	98.32	43.63
SW 11	97.95	49.59
SE 2	97.41	46.33
SE 13	96.00	47.62
N 11	95.47	42.21
SE 16	94.81	46.27
Correlation Coefficient, r		0.6645

MANUFACTURING REPORT

FACTORY ____________

Start of Crop ____________ Run Number ________ From ____________ To ____________

OPERATING DATA	RUN	TODATE
CROP DAYS		
TIME: Grinding, Hours		
Lost, Hours		
Lost, % of Total Time		
CANE: Purchased, Gross Tons		
Ground, Gross Tons		
Ground, Gross Tons per Hour		
Ground, Net Tons		
EXTRACTION: Pol		
Mixed Juice		
Normal Juice		
Maceration % Cane		
Dilution % Cane		
Milling Loss		
Load Rate		
Trash % Cane		
Bagasse % Cane		
Filter Cake % Cane		
Boiling House Efficiency		

PRODUCTION DATA	RUN	TODATE
SUGAR: Raw, Made as Produced, lbs		
Other, Made as Produced, lbs		
Total, Made as Raw Value, lbs		
Estimated in Process as Raw Value, lbs		
Made and Estimated as Raw Value, lbs		
Yield, M&E Raw Value, lbs per Gross Ton of Cane		
Yield, M&E Raw Value, lbs per Net Ton of Cane		
COMMERCIAL MOLASSES: Made as Produced, gals		
: Made as _____ °Brix, gals		
Estimated in Process as _____ °Brix, gals		
Made and Estimated as _____ °Brix, gals		
FINAL MOLASSES: Made as Produced, gals		
Made as 80°Brix, gals		
Estimated in Process as 80°Brix, gals		
Made and Estimated as 80°Brix, gals		
M&E 80°Brix, gals per Gross Ton Cane		
M&E 80°Brix, gals per Net Ton Cane		

ANALYSES		Brix	Pol	Purity	Moisture	Fiber	R.S.	R.S. Ratio	Sucrose	Ash	R.S.-Ash Ratio	Acid	pH
Cane	Run												
	Todate												
Bagasse	Run												
	Todate												
Filter Cake	Run												
	Todate												
Sugar, Raw	Run												
	Todate												
Sugar, Other	Run												
	Todate												
Commercial Molasses	Run												
	Todate												
Final Molasses	Run												
	Todate												
Sample Mill Juice	Run												
	Todate												
Undiluted Crusher Juice	Run												
	Todate												
Normal Juice	Run												
	Todate												
Mixed Juice	Run												
	Todate												
Last Expressed Juice	Run												
	Todate												
Clarified Juice	Run												
	Todate												
Syrup	Run												
	Todate												
A Massecuite	Run												
	Todate												
B Massecuite	Run												
	Todate												
C MASSECUITE	Run												
	Todate												
A MOLASSES	Run												
	Todate												
B Molasses	Run												
	Todate												
Magma	Run												
	Todate												
	Run												
	Todate												

SUPPLIES USED	QUANTITY RUN	QUANTITY TODATE	PER GROSS TON CANE RUN	PER GROSS TON CANE TODATE
Gas, MCF				
Fuel Oil, gals				
Lime, lbs				
Acid, lbs				
Caustic Soda, lbs				

PRODUCTS SHIPPED	RUN	TODATE	ON HAND
Raw Sugar, lbs			
lbs			
Com. Mol., gals			
gals			
Fin. Mol., gals			

MISCELLANEOUS	RUN	TODATE
Rainfall, in		
First Freeze, Date		
Temp		
Hardest Freeze, Date		
Temp		
Total Hours Below Freezing		
Number Days Below Freezing		
Corrected Standard Tons Cane		
Salvage Cane, Net Tons		
Acidity Deductions, Net Tons		
Other Cane: (Toll, etc.) Gross Tons		
Run Number		
Sugar, R.V., lbs.		
Mol, 80°Brix, gals		

POL BALANCE	POL, TONS RUN	POL, TONS TODATE	% POL EXTRACTED RUN	% POL EXTRACTED TODATE	% GROSS CANE RUN	% GROSS CANE TODATE
Final Molasses						
Filter Cake						
Undetermined						
Boiling House Loss						
Sugar						
Commercial Molasses						
Juice			100.000	100.000		
Bagasse						
Cane						

LOST TIME	HOURS RUN	HOURS TODATE	PER CENT RUN	PER CENT TODATE
Holidays				
Rain				
No Cane				
Machinery				
Cleaning				
Total				

REMARKS

Superintendent

Chief Chemist

Factory
SW 5
SE 7
SW 9
SW 1
SE 18
SE 11
SE 8
SE 17
SE 14
SE 3
N 9
SW 11
SE 2
SE 13
N 11
SE 16

Correlat
Coeffici

SECTION II

DEFINITIONS FOR RAW SUGAR FACTORY CONTROL IN LOUISIANA

The appended terminology and definitions of terms covering practices in the Louisiana raw sugar industry are suggested to provide for a more uniform system of reporting factory operations and the interpretation of such reports. Bases for these proposals are:

1. System of Sugar Factory Control, Second Edition, Special Committee on Uniformity in Reporting Factory Data, International Society of Sugarcane Technologists, 1955.
2. Commonly accepted practices in the Louisiana raw sugar industry.

Where possible, and where substitution should not lead to confusion, the definitions and terms as proposed by the International Society of Sugar Cane Technologists are proposed. These are identified by ISSCT. Usage peculiar to Louisiana which it is felt should be retained is identified by La. In several instances the ISSCT terminology and definition are given in addition to the local practice for purposes of discussion.

An example of preference for the ISSCT terminology is the use of the term pol instead of sucrose. Pol, as the single or direct polarization of sugar, covers what has heretofore been referred to in Louisiana as sucrose. As proposed, sucrose is properly reserved for the doublepolarization method. An exception to the above philosophy would be the retention of the term "sucrose" as referring to normal juice quality for cane payment. General usage of this term by both growers and processors suggests the adviseability of retaining sucrose in this context.

An example of the continued use of a Louisiana term in preference to the ISSCT nomenclature is the term retention as used locally in preference to boiling house recovery as suggested by the ISSCT.

This section is divided into the following three subsections covering specific categories of terms:

Feed, Product, and Miscellaneous Terms

Mill and Boiling House Control

Analytical Terms

Generally, terms specific to cane payment in Louisiana have been omitted from this presentation unless such terms appear in the factory operating reports. It is felt to be advisable to cover the subject of cane payment in a separate report.

J.J. Seip
5/30/1964

DEFINITIONS FOR RAW SUGAR FACTORY CONTROL IN LOUISIANA

FEED, PRODUCT, AND MISCELLANEOUS STREAMS

Gross Cane (La.)

La.: The raw material as delivered to the factory and weighed over the cane scales.

Note: Unless otherwise indicated, it is the practice to report factory control figures on the basis of gross cane.

Trash (La.)

La.: Green or dried leaves, sugarcane tops, dirt, and all other extraneous material delivered with the sugarcane. [1]

Net Cane (La.)

La.: The quantity of sugarcane obtained by deducting the weight of trash from the gross weight of sugarcane as delivered by a producer.[2]

Standard Sugarcane (La.)

La.: Net sugarcane, containing 12 percent sucrose in the normal juice with a purity of at least 76.00 but not more than 76.49 percent.[3]

Note: Standard sugarcane as so defined is the standard of cane quality for cane payment in Louisiana. It is a calculated value arrived

---

[1] Prices Sugarcane, Louisiana, 1963 Crop, Sugar Determination 874.16, United States Department of Agriculture, Item (a) (6).

[2] Ibid., Item (a) (5).

[3] Ibid., Item (a) (7).

at by applying to the net sugarcane delivered by a producer factors reflecting premiums for normal juice sucrose and purity above the levels stated above - and penalties for sucrose and purity below these levels.

Increasingly it is becoming the practice for factories to report in the daily and periodic operating reports the tons of standard sugarcane and the yield per ton of standard sugarcane for the period reported.

Example: Given the following date, convert the net tons of cane as delivered to standard tons of sugarcane:

Grower A delivers today 186.989 net tons of cane. From the average sample mill juice analysis, his normal juice quality is:

Brix	=	16.60
Sucrose	=	12.50
Purity	=	75.30

Then:

Quality (sucrose) factor for 12.50 sucrose = 1.050[4]
Purity Factor for 75.30 purity = 0.958[5]
Tons adjusted for sucrose = net tons x quality factor=
186.989 x 1.050 = 196.338
Standard tons = tons adjusted for sucrose x purity factor=
196.338 x 0.958 = 188.092

Note 2: If the calculated value (Winter-Carp) method of settlement for salvage cane is used, the cane so treated is not reflected in the reported standard sugarcane. Furthermore, acidity deductions applied to freeze damage cane are not reflected in this figure. For these reasons, for purposes

---

[4] Ibid., Item (c) (1).

[5] Ibid., Item (c) (2).

of factory control, it is suggested that a corrected standard sugarcane be reported in the operating reports. This figure can be calculated from the data in Form SU 128, "Prices Paid for Sugarcane with Related Information," in the manner shown in Table A.

Bagasse (ISSCT)

ISSCT: The residue obtained from crushing cane in one or more mills, known respectively as first mill bagasse or final mill bagasse, etc., or simply bagasse, when the material from the last mill is referred to.

Crusher Juice (La.)
First Expressed Juice (ISSCT)

ISSCT: The juice expressed by the first two rollers of the tandem.

Note: The above definition applies to either a two-roll or three-roll crusher.

Because of the frequency of cane washing in Louisiana with the subsequent dilution of the crusher juice, it is necessary to define the following term:

Undiluted Crusher Juice: Crusher juice which has not been diluted by wash water on the cane carrier or if the cane is being washed in the carrier, the quality of the crusher juice which would be predicted without wash water.

Since normal juice quality is inferred from the crusher and mixed juice inspections, the need for an "undiluted" crusher juice is evident where cane washing is practiced. The undiluted crusher juice quality is based on the sample mill juice inspections and the dilution compensation factor, (DCF).

Where cane washing is intermittent, the DCF is obtained from date prior to the wash period. Specifically, the "undiluted" crusher juice Brix is divided by the daily average sample mill juice Brix for a period of several days prior to the wash period.

Where cane washing is continuous, the DCF is determined from periodic tests of at least one hour's duration during which the washing is discontinued. During the test, samples of cane are removed from the carrier and samples of crusher juice are collected. The sample cane is ground in the sample mill and the sample mill and crusher juice are analyzed. The DCF is determined as follows:

$$\text{DCF} = \frac{\text{Undiluted Crusher Juice Brix}}{\text{Sample Mill Juice Brix.}}$$

Subsequently a daily factory undiluted crusher juice Brix is calculated by multiplying the average Brix of all sample mill juice samples for the day by the dilution compensation factor as follows:

$$\begin{array}{c} \text{Daily Average} \\ \text{Undiluted} \\ \text{Crusher Juice Brix} \end{array} = \begin{array}{c} \text{Daily Average} \\ \text{Sample Mill} \\ \text{Juice Brix} \end{array} \times \text{DCF}$$

The daily average undiluted crusher juice <u>pol</u> is calculated by multiplying the undiluted crusher juice Brix as determined above by the 24-hour average purity of the (diluted) crusher juice as follows:

$$\begin{array}{c} \text{Daily Average} \\ \text{Undiluted} \\ \text{Crusher Juice Pol} \end{array} = \begin{array}{c} \text{Daily Average} \\ \text{Undiluted} \\ \text{Crusher Juice Brix} \end{array} \times \frac{P}{100}$$

where: P is the daily average (diluted) crusher juice purity.

TABLE A

CALCULATION OF CORRECTED TONS OF STANDARD SUGARCANE[1]

Source of Cane	Cane Delivered Net Tons (A)	Cane Delivered Standard Tons (B)	Amount Due Account of Sugar, $ (C)	Allowable Deductions Account of Acidity, $ (D)	Net Amount Due Account of Sugar, $ (E)
Standard Cane[2]	210,015.630	219,787.657	1,538,513.62	650.02	1,537,863.60
Salvage Cane[3]	10,662.200	-	48,513.01	-	48,513.01
Total Cane	220,677.830	219,787.657	1,587,026.63	650.02	1,586,376.01

(H) Cost per Standard Ton (C-1) $\div$ (B-1) = 1,538,513.62 $\div$ 219,787.657 = 7.000

(I) Corrected Standard Tons of Sugarcane (E-3) $\div$ (H) = 1,586,376.61 $\div$ 7.000 = $\underline{226,722.396}$

[1]These calculations are based on information as would be presented in Form SU 128, "Prices Paid for Sugarcane and Related Information."

[2]The cane may have been settled on a season's average or a weekly average price of raw sugar.

[3]Settlement for salvage cane in this example is by the Calculated Value (Winter-Carp) Method. If the settlement had been by the Scaled-Down Method, the Standard Tons would have been indicated.

Last Expressed Juice (ISSCT)

ISSCT: The juice expressed by the last two rollers of the tandem.

Residual Juice (ISSCT)

ISSCT: The juice left in the bagasse; bagasse minus fiber.

Mixed Juice (ISSCT)

ISSCT: The juice sent from the crushing plant to the boiling house.

Normal Juice (La.)
Undiluted Juice (ISSCT)

La.: The juice extracted from sugarcane by a mill tandem when no maceration water is used.

Note: The Brix of normal juice is calculated from the Brix of the undiluted crusher juice and a dry milling factor. This factor may be determined by periodically operating the mills for a time without maceration water and determining the Brix of the mixed juice so obtained and the first expressed juice. For example, Brix first expressed juice = 19.50; Brix mixed juice (dry milling) = 18.97; dry milling factor = 18.97 ÷ 19.50 = 0.973. Through accepted practice, a dry milling factor of 0.97 is used and dry milling tests are rarely run. The purity of the normal juice is assumed to be equal to that of the mixed juice.

Example: Given - Undiluted Crusher Juice Brix = 19.00
Dry Milling Factor = 0.97
Mixed Juice Purity = 80.50

Determine - Normal Juice Brix, Sucrose, and Purity
Then: Normal Juice Brix = 19.00 x 0.97 = 18.43
Sucrose = 18.43 x 80.50/100 = 14.84
Purity = 80.50

ISSCT: The juice expressed by the mills or retained in the bagasse, corrected for imbibition water. For purposes of calculation, it has the

Brix of the primary (crusher) juice.

Clarified Juice (ISSCT)

ISSCT: The main product passed out of the section of the factory which is devoted to clarification of the juice. The clarified juice normally goes on into the evaporators, and constitutes the whole of the major portion of the "Evaporator Supply Juice".

Filtered Juice (ISSCT)

ISSCT: The combined filtrate from the filters.

Subsider Juice (ISSCT)

ISSCT: The juice decanted from the mud or settlings in the course of the (mud) clarification process.

Filter Cake (ISSCT)

ISSCT: The residue removed from process by filtration.

Syrup (ISSCT)

ISSCT: The concentrated juice from the evaporators.

Massecuite (ISSCT)

ISSCT: The mixture of crystals and mother liquor discharged from the vacuum pan. Massecuites are classified, according to descending purity, as first, second, etc., or A, B, etc.

Molasses (ISSCT)

ISSCT: The mother liquor separated from the crystals by mechanical means. It is termed first, second, etc., or A. B. etc., according to the massecuite from which it is obtained.

Magma (ISSCT)

ISSCT: A mixture of crystals and sugar liquor produced by mechanical means.

Note: Magma as so defined may include C sugar mingled with clarified juice or syrup for an A or B strike footing - or in refinery practice, raw sugar mixed with affination syrup or water.

Seed (La.)

La.: Fine granulated sugar in a saturated solution or the initial grain resulting from spontaneous nucleation (waiting method - or shock seeding).

Footing (La.)

La.: A charge for a strike of sugar - such charge to consist of a magma or a cut from another strike.

Sugars (ISSCT)

ISSCT: The crystals (including any adherent molasses) recovered from the massecuite, usually in centrifugals. According to local conditions, different types of sugars are produced to be either shipped or returned to process.

MILL AND BOILING HOUSE CONTROL

Maceration (La.)
Imbibition (ISSCT)

ISSCT: The process in which water or juice is put on the bagasse to mix with and dilute the juice present in the latter. The water so used is termed imbibition (in Louisiana - maceration)

Note: The ISSCT makes a distinction between imbibition and maceration. Maceration is defined as the process in which the bagasse is steeped in the excess of water or juice, generally at a high temperature.

Dilution (La.)
Dilution Water (ISSCT)

ISSCT: The portion of imbibition or maceration water present in the mixed juice.

La.: Dilution as used in Louisiana would include the dilution water as defined above plus water from mill washing and journal bearing water.

Note: Dilution per cent Cane: This figure is obtained from the Brix of the Normal Juice and the Brix of the mixed juice as follows:

$$\frac{\text{Brix Normal Juice} - \text{Brix Mixed Juice}}{\text{Brix Normal Juice}} \times 100 = \text{Dilution \% Mixed Juice}$$

$$\text{Dilution \% Mixed Juice} \times \frac{\text{Mixed Juice \% Cane}}{100} = \text{Dilution \% Cane}$$

Juice Extraction (ISSCT)

ISSCT: The percentage weight of juice extracted by the mills. In each case it should be definitely stated what kind of juice is referred to, and to which basis the percentage relates.

Note: In Louisiana the practice is to report:

Mixed Juice Extraction: This is determined as follows:

$$\frac{\text{Weight of Mixed Juice}}{\text{Weight of Cane}} \times 100 = \text{Mixed Juice Extraction}$$

Normal Juice Extraction: This is determined from the Mixed Juice extraction and the Dilution % Cane as follows:

Mixed Juice - Dilution = Normal Juice Extraction
Extraction % Cane

Pol Extraction (ISSCT)

ISSCT: Pol in mixed juice percent pol in cane.

Milling Loss (ISSCT)

ISSCT: The percentage ratio of sucrose (pol) in bagasse to fiber in bagasse.

Load Rate (La.)

La.: Tons of fiber per hour per total surface area of all mills.

Note: This criterion of milling capacity is calculated as shown in the following example:

Total Roll Surface Area:

1-2 roll crusher:	36 in. Dia. x 78 in. long =	122.46 sq. ft.
5-3 roll mills :	36 in. Dia. x 78 in. long =	918.45 sq. ft.
Total		1,040.91 sq. ft.

Tons fiber per hour: 221.70
Fiber % Cane : 13.15
Then:

$$\frac{221.70 \times 0.1315}{1040.91} = 0.02801 \text{ tons fiber/hour-sq. ft. roll surface area}$$

Actual Retention (La.)
Boiling House Recovery (ISSCT)

ISSCT: The sucrose (pol) in sugar produced percent sucrose (pol) in mixed juice. To be qualified by adding "sucrose" or "pol" as the case may be.

Note: The ISSCT definition covers both retention as used in Louisiana and boiling house recovery as recommended by the ISSCT. In Louisiana the retention is understood to be reported on a pol basis.

Theoretical Retention (La.)
Basic Boiling House Recovery (ISSCT)

La.: The percentage of pol in mixed juice or stock which would be recovered in sugar according to the retention formula being used.

ISSCT: The percentage of the sucrose in the mixed juice which would be recovered in sugar according to the s-j-m formula, adopting values of 100 and 28.57 for the gravity purities of the sugar and final molasses, s and m respectively, and for j, the gravity purity of the mixed juice.

Note: This is in effect the Winter-Carp theoretical retention, except it requires a sucrose basis.

Theoretical Retention Formulas

SJM Formula: Given a mixed juice or stock of J purity, and producing a sugar of S purity, with a molasses of M purity, the total sucrose (or pol) of the original material which will go into sugar will be:

$$x = \frac{S(J - M)}{J(S - M)}$$

Where: x is the fraction of sucrose (or pol) in the original material which will go into sugar.

J is the juice or stock purity.

S is the sugar purity.

M is the molasses purity

Example: Given the following data, determine the fraction of pol which will be recovered in sugar from the stock determined at the end of a run.

Stock purity, J = 75.52
Average sugar purity for the run, S, = 97.50
Average molasses purity for the run, M, = 32.25

$$x = \frac{97.50\ (75.52 - 32.25)}{75.52\ (97.50 - 32.25)} = 0.8570$$

Winter-Carp Formula: This formula was developed in Java based on the observation that one part of non-sucrose (or non-pol) in the final molasses held 0.4 parts of sucrose (pol).[6] The formula is:

$$x = (1.4 - 40/P)$$

where: x is the fraction of sucrose (or pol) in the original material which goes into sugar.

P is the purity of the mixed juice or material.

Note: This formula is equivalent to the SJM formula with a sugar purity of 100 and a purity of 28.57 for the final molasses.

Example: From the following, determine the theoretical retention for the run.

Average purity of Mixed Juice = 80.00

$$x = (1.4 - 40/80.00) = 0.90$$

Boiling House Efficiency (La.)
Boiling House Performance (ISSCT)

La.: The percentage relation between the actual retention and the theoretical retention.

Note: Dr. Meade notes that the boiling house efficiency as determined in Louisiana is subject to an inherent error. The theoretical retention by the Winter-Carp formula assumes

[6] G. P. Meade and G. L. Spencer, Cane Sugar Handbook, Ninth Edition, New York: John Wiley and Sons, Inc., 1963, p. 649.

a sugar of 100 purity. However, the actual retention is based on the purity of sugar as produced. The actual retention and the subsequent boiling house efficiency are in error on the high side. To correct this it would be necessary to recalculate the actual retention to a sugar of 100° purity before dividing by the theoretical retention in order to obtain the proper efficiency number.[7]

Example: Given the following data for the run, determine the boiling house efficiency (BHE) by the usual method and the corrected BHE.

Theoretical Retention = 0.9000
Actual Retention = 0.8740
Average Sugar Purity for the Run = 97.50

Then:

$$\text{BHE} = \frac{0.8740}{0.9000} \times 100 = 97.20$$

BHE corrected for the purity of sugar:

E.S.G. Factor = 0.9899
Actual Retention E.S.G. = 0.8740 x 0.9899 = 0.8652

$$\text{BHE (Corr)} = \frac{0.8652}{0.9000} \times 100 = 96.13$$

Comment: In view of the fact that the majority of factories in the state make a raw sugar, it is felt that the uncorrected BHE is satisfactory for comparison of factory performance within the state.

ISSCT: The percentage relationship between the boiling house recovery, E.S.G., (on a sucrose basis), and the basic boiling house recovery.

Standard Sugar

Comments: In order to properly compare the performance of factories

---

[7] Ibid., p. 650.

producing sugar of different quality, it is obviously necessary to convert the quantity of sugar produced into a comparable equivalent. In Louisiana, raw value and 96° sugar are both used. In some areas the use of E.S.G. as recommended by the ISSCT has been adopted.

Raw Value (La.): In an article titled "What is Raw Value?" Sugar Reports comments:

> "Since practically all of the sugar consumed in the continental United States is refined before final distribution, conversion of all weights of sugar to a refined basis would seem to be a 'natural.' However, almost three-fourths of the total of our sugar supply is first marketed in form of raw cane sugar under the Sugar Acts. In recognition of this fact, the Sugar Acts have established and defined a 'raw value' as the common denominator of sugar weights for all computations under the acts.
>
> "---. Prior to 1934, raw sugar typically polarized about 96° and sugar of that quality had already become the base grade for many contractual purposes. It was found that an average of about 1.07 pounds of 96° raw sugar were required to produce one pound of refined sugar, and accordingly 96° raw sugar was assigned the unit value of 'one' in the raw value formula and refined sugar was determined to be worth 1.07 times as much. For sugars polarizing between 96° and 100° the raw value factors are intermediate between 1.0 and 1.07 - - - - - - -, and the same scale of relative values was extended downward to sugars polarizing as low as 92°. - - - -"[8]

Example: From the data below, calculate the raw value factor and the tons sugar produced, raw value.

[8] Sugar Reports, USDA, Washington, D.C., No. 132, April, 1963, pp. 8-12.

Average sugar pol today = 96.50
Tons of sugar as produced today = 180.600

pol - 92 = a = 4.50
a x 1.75 = b = 7.875
b + 93 = c = 100.875

Raw value factor = $\frac{100.875}{100}$ = 1.00875

Tons of sugar produced, raw value =

180.600 x 1.00875 = 182.180

96° Test Sugar (La.): As the name implies, this is the equivalent sugar which a factory would produce at 96° polarization.

Example: From the data below, calculate the equivalent tons of 96° test sugar produced today.

Tons of sucrose in sugar produced today = 174.279

Then:
Tons of equivalent 96° sugar produced = $\frac{174.279}{0.96}$ = 181.541

Note: The above calculation overlooks the effect of the purity of the sugar as produced on the retention of the sucrose (or pol) in the sugar. A factory producing a low purity sugar would have a higher retention of sucrose (or pol) in sugar than a factory producing a high purity sugar. In recognition of this, E. M. Copp proposed a system in in which the equivalent 96° sugar was calculated assuming a raw sugar purity of 97.00 (96° pol and 1.03 percent moisture). The "Copp" factor was in effect the theoretical retention by the S.J.M. formula for a sugar and molasses purity of 97.00 and 28.17 respectively, divided by 0.96.[9] This corretion of course still did not facilitate comparison

[9] Spencer and Meade, op. cit., p. 650.

among factories producing sugars of significantly varying quality and purity.

<u>Equivalent Standard Granulated, E.S.G. (ISSCT)</u>: The quantity of pure dry sucrose (100 percent sucrose, 100 purity) which would theoretically be obtained from a sugar or other raw material using the s-j-m formula and assuming a gravity purity of 28.57 for the final molasses.

<u>Example</u>: From the data below, calculate the equivalent tons of E.S.G. produced today:

Tons of sugar as produced = 180.600
Purity of sugar = 97.50
Then:
E.S.G. factor for a sugar of 97.50 purity = 0.9899[10]
Tons of equivalent E.S.G. produced = 180.600 x 0.9899 = 178.776

<u>Available Sugar</u>

La.: The sugar that a factory should obtain from juice or other raw material of a given analysis.

<u>Note</u>: In calculating available sugar, one of the theoretical retention formulas is used and the available sugar is expressed in terms of one of the standard sugars.

<u>Example 1</u>: Given the following data, determine the available 96^o sugar in stock at the end of the run.

Tons of sucrose in stock = 310.156
Then:
Tons available 96^o sugar in stock $= \frac{310.156}{0.96} = 323.079$

<u>Example 2</u>: Given the following data, determine the available sugar in stock, raw value, at the end of the run.

Tons of sucrose in stock = 310.156
Average sugar polarization for the run = 96.50
Then:

---

[10] Spencer and Meade, op. cit., p. 652.

Tons available sugar as produced - 310.156/0.9650 = 321.405
Raw value factor = 1.00875
Tons available sugar, raw value = 321.405 x 1.00875 = 324.217

In these examples, available sugar expressed as 96^{o} sugar was 323.079 tons while that expressed as raw value was 324.217 tons. In the case such as this where the usual grade of raw sugar was assumed, the difference in available sugar calculated to 96^{o} and to raw value is reasonably small. For this reason it is felt that no great error is involved in calculating available sugar as 96^{o} for simplicity; and reporting it as raw value for purposes of standardization. The difference would be greater in a high grade sugar operation as turbinado.

Example 3: In calculating the Daily Operating Report, it is usual to determine the available sugar from the sucrose extracted for the 24 hour period. This determination is based on the Winter-Carp theoretical retention formula, the boiling house efficiency from the previous run, and expressed as 96^{o} sugar.

From the following data determine the tons available 96^{o} sugar today.

Sucrose extracted today, tons	= 295.699
24 hour average mixed juice purity	= 70.34
BHE from the last run	98.00

Then:

Theoretical retention = (1.4-40/70.34) = 0.8313
Actual (predicted) retention = 0.8313 x 0.9800 = 0.8147
96^{o} available sugar factor = 0.8147/0.96 = 0.8486
Tons available 96^{o} sugar today = 295.699 x 0.8486 = 250.930

Again, the available sugar could have been calculated on a raw value basis using the 24 hours average pol of sugar. The answer would have been reasonably close to that calculated as 96^{o} sugar.

Yield

La: The pounds of sugar produced per ton of cane. The yield is usually expressed in standard sugar as raw value or 96^{o} sugar, and the basis, net cane or gross cane is noted.

The yield is occasionally expressed as sugar per cent of cane in which case it is similar to the ISSCT definition below.

ISSCT: Commercial sugar percent cane without regard to the composition of the sugar.

Note: For comparison the ISSCT recommends the use of E.S.G., so that the yield would then be Yield, E.S.G.

ANALYTICAL TERMS

Fiber (ISSCT)

ISSCT: The dry, water-insoluble matter in the cane.

Normal Weight (ISSCT)

ISSCT: The weight of pure sucrose which, when dissolved in water to a total volume of 100 ml at $20^{o}C$, gives a solution reading 100 degrees of scale when examined in a saccharimeter, in a tube 200 mm long, at $20^{o}C$.

Note: As used in Louisiana, a normal weight of 26.000 grams will give a reading of $100^{o}S$ on the international sugar scale.

Pol (ISSCT)

ISSCT: The value determined by direct or single polarization of the normal weight solution in a saccharimeter. The term is used in calculations as if it were a real substance.

Note: As with Brix, the terms "pounds pol," "pol in juice," and "pol extraction" are being used with increasing frequency.

Sucrose (ISSCT)

ISSCT: The pure chemical compound of that name, also known as saccharose or cane sugar.

Note: Sucrose as so defined is commonly determined by the Clerget method of inversion and double polarization. In Louisiana, the continued use of normal juice "sucrose" (where pol is implied) would appear to be justified in view of the general acceptance and usage of the term in cane payment.

Brix (La.)

La.: The per cent by weight of soluble solids in solution as indicated by the Brix hydrometer.

Note: The ISSCT notes that the Brix of a solution of pure sucrose in water is a direct measure of the percentage of sucrose by weight in the solution.

Refractometer Brix (La.)

La.: The percent by weight of soluble solids in solution as indicated by the sugar refractometer.

Dry Substance (ISSCT)

ISSCT: The material remaining after drying the product.

Insoluble Solids (La.)

La.: The insoluble solids in solution. Such material may be removed by centrifuge or by filtration and is generally expressed on a dry basis.

Purity (ISSCT)

ISSCT: The percentage proportion of pol in the Brix solids.

Gravity Purity (ISSCT)

ISSCT: The percentage proportion of sucrose in the Brix solids.

True Purity (ISSCT)

ISSCT: The percentage proportion of sucrose in the dry substance.

Reducing Sugars or R.S. (ISSCT)

ISSCT: The reducing substances in cane and its products --- calculated as invert sugar.

Note: It is noted that the components of invert sugar are termed "dextrose" and "levulose". The term "glucose" to designate either invert sugar or dextrose is to be avoided as it may lead to misunderstandings.

Ash (ISSCT)

ISSCT: The residue remaining after burning off all organic matter.

Note: Because of its simplicity, sulphated ash - reported as determined with no correction - is being used in preference to carbonate ash.

R.S. Ratio (ISSCT)

ISSCT: The percentage ratio between reducing sugars and pol.

Note: For reasons stated above, this term is to be preferred to the term "glucose" ratio.

R.S. - Ash Ratio (ISSCT)

ISSCT: The percentage ratio between reducing sugars and ash.

Note: Again this term is preferred to "glucose"-ash ratio.

Moisture

This commonly used analytical term either defies definition, or the definition has been omitted in technical publications dealing with sugar factory terminology. It would appear to be proper to define moisture as that material removed by drying - generally at 100 to 105°C.

Safety Factor

This is a term to define the keeping quality of sugar. It is calculated as:

$$\frac{\text{Moisture}}{100 - \text{Polarization}}$$

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS
Baton Rouge, Louisiana
February 7, 1963

Address by Dr. John A. Hunter, President
Louisiana State University
and
Agricultural and Mechanical College

I appreciate your generous invitation to dine with you this evening and to participate in your annual meeting. It is always a pleasure for me to meet and become closer acquainted with organizations which play an important part in the economic development of our state and region.

I trust that your conference today has been both a beneficial and enlightening one for each of you -- and one in which definite progress has been made by your Society. You have installed officers for the new year and each of them has been charged with considerable responsibilities and duties. But I am sure you recognize that the wellbeing of your organization -- and of the entire sugar cane industry -- depends not only upon the effective leadership exercised by those chosen to lead, but also upon the individual efforts of every member.

Because of my position and my interest in Louisiana State University, it is only natural that I should have an interest in the sugar cane industry -- a very definite interest. Agriculture and its related fields -- particularly sugar cane growing and refining -- for many decades have occupied a most prominent position in the overall mission of LSU. Actually, as you gentlemen well know, this state has become almost synonymous with sugar cane and its processed products, sugar and syrup.

But my own personal interest in your industry goes a bit further, since I grew up in one of the most productive sugar cane parishes in the state. As a youngster in Terrebonne Parish, the height of an entertaining evening for me consisted of riding on a beat-up old model-T truck over to Cox's

sugar mill to indulge in every youngster's delight -- eating sugar cane.

There is a story about those days which my friends like to tell on me. During the sugar cane season when I was a little fellow my father often would peel cane and cut it into small pieces for me to chew. He usually did this whenever I asked him to. One day, without my asking, he began peeling a stalk of cane and cutting it up. I sat and watched him all the while without saying a word. Then when he had finished, I calmly picked up the dish, walked to the back door and threw the cane into the yard, remarking somewhat indiscreetly: "When I want you to peel cane for me, I'll let you know." Yes, you guessed correctly, I got a whale of a whipping. And from that point on, my respect for sugar cane grew considerably.

So, as you can see, I have a rather intimate acquaintance with your business, at least from the consumer's point of view.

This evening I should like to comment briefly on one aspect of the sugar cane industry: its direct relationship to the field which I represent, education. I think it necessary to acknowledge from the beginning that, despite an early introduction to sugar cane, my knowledge and understanding of the more technical aspects of growing, processing and marketing its finished products are somewhat limited. Quite naturally, then, I do not intend to talk to you in technical terms tonight. However, in my daily activities as president of LSU it is necessary and inevitable that I acquire a general understanding of an industry which is of such importance to Louisiana and the South.

In spite of my limited technical knowledge of your field, I do feel qualified to make one rather pertinent observation which, I believe, cannot be questioned: The unprecedented growth of the agricultural industry as a

whole, and the sugar cane industry in particular, has been possible because of a close association with institutions of higher education and the essential tools for progress which education can offer.

The more widely publicized technological exploits which our nation has made in the exciting field of space exploration sometimes tend to obscure the fact that this same nation also has developed the most abundant, the most productive agricultural economy the world has ever known. And it should be remembered that ours is an agricultural economy, which like its counterpart symbolized by the booster rocket, the satellite and the space capsule, is also grounded firmly on the launching pad of science and technology.

Without a doubt, yours is an industry that was born, developed and matured by two unique factors -- experiment and research. And I think I can say, without any undue modesty, that the field which I represent -- higher education -- through extensive programs of experiment and research, has played a major role in this development.

As I am sure you already know, LSU is only one example of what organized programs in higher education can contribute to the vast field of agriculture and to the American sugar cane industry. I don't intend to sound my own horn because LSU certainly is not alone in its contributions to agriculture. A total of 68 land-grant colleges and universities spread across the 50 states have as one of their prime objectives the continued development of the whole agricultural picture.

And, in addition, sugar cane experiment and research is not a one-man nor one-agency job -- rather, it is a cooperative effort of numerous organizations and a great many individuals -- the U. S. Department of Agriculture, the American Sugar Cane League, your own Society and institutions like Louisiana State University. The list of achievements in the sugar cane industry, which were made possible through the combined efforts of these groups, reads long

and impressive, indeed. Let's briefly review some of the past accomplishments which this combination of resources has inspired and some of the experimental and research work currently being conducted.

As early as 1885 experimental studies of sugar cane were begun in this state by the old Louisiana Sugar Experiment Station in such areas as fertilization, row widths, drainage, methods of cultivation and the physiology of the sugar cane plant. The following year the new varietal sugar cane program had its beginnings and, as you know, is still being carried on today, some 75 years later. Through productive experiment and research, various new commercial varieties have been developed and released to the agricultural world periodically since the year 1898.

Many of you recall the dark days of the 1920's when the mosaic virus threatened to wipe out completely the sugar cane industry in Louisiana. And it was the introduction of new varieties which were resistent to the disease -- varieties which were products of intensive research and experiment -- that preserved your industry and put it back on its feet.

Through such remarkable contributions of research -- made possible because of cooperation by many organizations and individuals -- sugar cane in Louisiana -- and in Florida as well -- has grown from a struggling infant business to a mature industry we know today as a 150 million dollar-a-year enterprise.

Naturally, such essentail efforts have not come to a halt simply because the sugar cane industry is a highly productive one today. Research and experiment are a continuing process, and they are very much in evidence today -- at LSU and elsewhere. Since 1948, LSU has developed an extensive sugar cane breeding program under the direction of the Department of Plant Pathology on the Baton Rouge campus. Both here and at the U. S. Department of Agriculture station at Canal Point, Florida, cane breeding research is

continuing to produce new and better commercial varieties.

The first variety developed from seedlings grown by the LSU Agricultural Experiment Station was released for commercial planting in 1958. Since then, a number of seedlings which have potential commercial value have resulted from this breeding program. Last year, for example, approximately 40,000 seedlings were established in our fields for further evaluation. Also during the past year some 170 commercially promising canes were tested in various areas across the state.

Because of highly successful experimental work, the use of chemicals to control weeds in sugar cane fields has increased tremendously during recent years. Both basic and applied research work in chemical control are continuing. A large number of chemicals are now ready for testing this year.

Of course, there are countless other examples of valuable research now underway that will determine, to a great extent, the future rate of progress of the sugar cane industry. Research of cane viruses, experiments in soil structure, physical condition and fertility and cost studies of production are being continued.

There still exists, and will continue to exist, a great many problems relating to the successful growing and manufacturing of sugar cane, just as there are serious problems facing education or any other progressive field. But I believe that through the partnership which you and LSU and hundreds of other individuals are united in, -- experiment and research which is producing abundant returns -- even the most difficult obstacles can be overcome and the most puzzling problems solved. This is true in the sugar cane industry and it is equally true in every other phase of agriculture.

Because there remain many problems to be solved, and because the sugar cane industry must continue to develop to its ultimate potential, this would

indicate to me that the time-proven relationship of higher education and agriculture -- and of higher education and sugar cane -- must continue to grow.

We are now living in a period quite appropriately described as the age of the superlative -- a dynamic new era when time and space and once-formidable barriers virtually have been erased, when the limitations of man are governed only by the fund of knowledge at his command.

Through a constantly expanding emphasis upon cooperative experiment and research -- and the knowledge necessary for progress which it imparts -- we can move into a world of even greater promise -- in agriculture, in sugar cane, in education and in every other worthwhile area of society.

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS
Baton Rouge, Louisiana
February 6, 1964

Address by Mr. G. C. Rawls, President
Louisiana Power and Light Company

A LOOK AHEAD

President Cancienne, Ladies, and Gentlemen--

It is certainly nice of you to invite me to come up and be with you this evening. I welcome the opportunity to visit with you and to be able to spend this time with you. Since the very beginning of our company, almost forty years ago, we have been associated with you. We render electric service to many of you. Our associations and dealings with you have always been pleasant, and we look forward to many more years of pleasant association.

I would like to point out that while our operations have grown considerably through the years and regardless of the fact that our general office is in New Orleans, we are essentially a rural company serving areas outside the major cities of Louisiana. We have about 15,000 miles of electric lines here in Louisiana; we are domiciled in Louisiana; we live in Louisiana; and all of our officers and directors live right here in Louisiana. So I come to you tonight as a representative of a business-managed, investor-owned, tax-paying, regulated electric utility.

Last year, with my wife, I made a trip around the world. We were gone 42 days and covered about 33,000 miles. We flew at speeds of about 550 miles per hour and at altitudes of about 6 miles.

By the year 1970, you will be traveling in jet planes at speeds of 1800 miles per hour and cruising 15 miles up. This is a statement made by Mr. Najeeb E. Halaby, Head of the Federal Aviation Agency. As of the last

week of December, 1963, according to Mr. Halaby, reservations had already been received for 45 of these planes, each reservation being accompanied by a deposit of $100,000. The plane, designated a Super-Sonic Transport or an SST, has not yet been designed. The jet engines that will power it have not been designed or built. This is cited for two reasons--

First, as a spectacular example of the speed of technological changes in the future;

Second, the faith that exists that the changes are coming.

Tonight I intend to talk to you about several things. I intend to talk about what we see ahead--

First, for our country in 1964;

Second, for Louisiana in 1964;

Third, about the electric utility business;

Last, some of the problems of the electric utility business.

The first is to talk to you on the Soaring Sixties. People keep asking, "Aren't the 60's ever going to soar?" The answer seems to be, "They're soaring now about as much an any other period soars other than in wartime with its accompanying inflation." This country has had steady growth over a long span of years--in wartime--in peace--in depression--and in prosperity. What you notice is that the trend moves steadily upward. In times of war there is a surge. In times of recession, a brief slowing occurs. In normal times, the growth is gradual. It all averages out. Over good times and bad times the growth is about 3 per cent a year. Numerical gains are larger in recent years than in the distant past, of course, because the United States economy is larger. But in terms of percentage gain, the rise has held fairly constant over the years. Only once in the 1930's was there a long period of lag. No one apparently expects a reoccurrence of this.

Employment has been setting records in recent months. Jobs have opened

up as business has invested billions to expand to develop new products and new industries. Despite gains, however, employment is a nagging problem with four million out of work. Several factors should be considered relative to this. These are:

1. There will always be moving and relocation of people and industry with the resultant effect on workers.

2. It should be remembered that not everyone in the United States wants to work. When they don't care to, then, of course, there is unemployment.

3. Seasonal work affects unemployment. Consider the case of agricultural workers and then some surveys of unemployment have been made at such times as to catch as unemployed the recently graduated high school students.

For these reasons, figures on unemployment will bear careful scrutiny.

A most important factor is that automation seems to be almost blameless relative to unemployment. There will be a few remarks about this later on.

People of our country are earning more than ever before in history. Prices are up. So are taxes. But people's incomes have gone up even faster. Average income per person after taxes and allowing for price increases is now 69 per cent above 1929.

Now to be more specific on 1964. An examination of the prognostications of the forecasters shows that without exception all agree that 1964 is going to be a banner year. Perhaps the most concise report is that of McGraw Hill Publishing Company based on the statistics of the U. S. Department of Commerce.

Output is expected to reach $615 billion with a tax cut effective early in the year and $605 billion without a tax cut. With the tax cut, this is an increase of 5 per cent over 1963; without the tax cut, the increase would be 3.5 per cent. All the major sectors of our national economy are expected to be higher in 1964, with the exception of our export surplus. Government spending, business investment, and consumer spending are all expected to increase

over 1963. The anticipated tax cut is expected to greatly stimulate consumer spending and if the tax cut does not become law early in the year, consumer spending is expected to increase only modestly.

It must be kept in mind that 1964 will be a national election year. The new President will be endeavoring to chart a course that will insure his re-election and, consequently, will be doing everything possible to insure prosperity. At the same time, work will go forward to try for world peace. Hence, the election theme will most likely be "Peace and Prosperity." This, without doubt, has had its effect on the forecasters' views of 1964.

Now let's turn to Louisiana for a moment to take a quick look at the economic, political, and industrial climate of the state. The year will see a host of new faces in Baton Rouge. In the House of Representatives of 105 members there will be 60 who are newcomers. In the Senate of 35 members there will be 16 who will be newcomers. At the same time, with the new Governor, there will appear other new faces in various appointive offices. While it seems certain that Mr. McKeithen will be our next Governor, it should be borne in mind that the general election is yet to be held. There will be a Republican candidate, Mr. Lyons, but it must be remembered that there has not been a Republican Governor here in Louisiana since Reconstruction days.

It is well to look at the level of employment in the State. While there are a few parishes where the level of employment is such as to have them classed as distress areas, it is felt that the figures or perhaps the obtaining of the figures is open to challenge. Generally, employment is quite good as might well be expected with a good general level of business activity.

There are heavy construction programs under way in the petroleum industry and in the pulp and paper industries. Petro-chemical plants likewise continue to show activity in construction. In addition to other requirements, many of these new industries have huge requirements for fresh water. Many of them need

barge line or ship side transportation. For these reasons there are numbers of them locating on the lower reaches of the Mississippi, below Baton Rouge, on down past New Orleans to the mouth of the Mississippi River. This river that was once regarded as a cross that we had to bear is now one of the State of Louisiana's greatest assets with its enormous quantity of fresh water and its ability to offer the means of ocean-going transportation up as far as Baton Rouge. The construction of the plants mentioned above provides jobs and also the completed projects give added impetus to the construction of homes and various service establishments for the added population.

Relative to population, it is expected that Louisiana will increase in population at approximately the same rate as the United States. Most of you know that this population increase is spotty. We have observed much slower growth in the northern portion of our system than in the southern. During the past five years, while we were adding 7,482 customers in the northern end, we added 32,530 customers in the southern.

The New Orleans area has experienced extensive growth. What is not generally recognized now is that outside of New Orleans proper but adjacent to it within the parishes of Jefferson, St. Bernard, and Plaquemines, there now exists a city that is approximately as large as Baton Rouge or Shreveport. These outlying parishes are expected to grow about twice as fast as the Greater New Orleans Area.

Activity in the Port of New Orleans continues high, and there is special activity in the handling of grain. This largely takes the place of the activity once in effect due to cotton shipments.

The agricultural results in 1963 in Louisiana were quite satisfactory with good yields and prices of cotton, sugar cane, rice, and forestry products. The residual funds from these bumper crops should provide funds for discretionary spending as well as for financing 1964 crops. It is generally conceded that 1964

will be an incentive good-crop year--but weather and other factors will actually determine whether or not there are good agricultural crops. The only agricultural product that is reported low in price is the price of cattle. This, no doubt, is a cyclical problem as a history of the cattle industry shows that beef prices have always moved in cycles. Heavy production invaribly brings low prices and production slows down. With decreased production, then price increases follow.

All of the above indicate a good year in 1964 although there are indications that there will be some areas that enjoy more prosperity than others.

Since I have been in the electric utility business all these many years and since this business renders such a vital and necessary service to you in your daily lives, I want to talk to you a little bit about it. First of all these are some 268,000 of you good people who buy your electric service from our company. When you turn on the switch you expect the electricity to be there. But have you ever given a thought as to just what is involved in accomplishing this?

First of all there are 1,525 of us at work to see that you do get your electricity when you turn the switch. This isn't always an easy job. Someone has to be at work all the time, both to provide the electricity and to make repairs when troubles happen. We have built up a reputation or a loyalty such that it matters not what happens or when it happens--we move immediately to restore the service. My sincere thanks go to you for your patience during these times, and I can't say enough in praise of the many fine men and women who have dedicated themselves to the job of seeing that you get the finest service obtainable.

This business is peculiar in that there can be no storage of the product awaiting the orders. This means that we must have the finest, most dependable system possible for instantly distributing the product. And remember, we can't make it for delivery to you until you have turned the switch.

In reality, the employees of our company have two jobs to do--first, they have the job of rendering service to our present customers; and second, the building of facilities to render good service to the new customers. Either of these is a full-time job. You can realize what is involved when I tell you that each year for the last ten years we have averaged adding 8,527 customers. This is the equivalent of a city of about 20,000 population each year. What we have to do is build the facilities, the poles, wire, transformers, et cetera, to hook up these customers. You see this going on every day right around you.

I would like to call your attention, however, to the building that is going on that you do not see. I refer to the generating stations, the transmission lines, and other facilities that are not so readily observed. In the construction of these facilities there is a great deal of planning involved. You just can't go down to the corner merchandise store and say, "Deliver me a generating unit."

The latest unit we have ordered is a 400,000 kw unit for installation in our Little Gypsy power plant. Some of you may perhaps wonder where we get the names of these power plants. All of you know of Sterlington and Ninemile Point. These plants are all named for plantations on which they are located--Sterlington for the cotton plantation between Bastrop and Monroe; Ninemile Point for the plantation on which it is located some nine miles above Canal Street of New Orleans; Little Gypsy for the name of the sugar cane plantation just upriver above the Spillway near La Place, Louisiana.

Getting back to this unit which will be known as Little Gypsy No. 2, I would like for you to know that it is being installed at an existing plant site--one that already has a unit in operation, Little Gypsy No. 1, which is the world's first plant capable of completely automated operation. (This is a story within itself and time does not permit me to dwell upon it.)

This new unit was engineered and planned in 1962, ordered in early 1963, and is scheduled for operation in 1966. It will cost about $26,000,000 of which about $10,000,000 will be spent in 1964. From this you can see that we not only have to believe in the future of Louisiana, we have to back this belief by the expenditure of hard cash.

Along with this unit, we commence this year the construction of a new high voltage transmission system commonly called an EHV or Extra High Voltage System that will operate at 500,000 volts. These two projects together with other distribution, transmission, and general expenditures produce a construction budget of some $36,000,000. While this is the largest expenditure that we have ever faced, it is a sample of what will be required to be spent over the next few years in order to make electricity in plentiful supply available to our present and expected customers here in Louisiana. There has always been a plentiful supply of low cost electricity available for you and to supply the industrial growth of our state.

Taxes are never a popular item; they should be shared by all if we are to have the things that we look to Government to provide. I refer to roads, schools, courts, protection from the enemy, et cetera. It will interest you to know that our company paid over $15,000,000 for taxes alone last year. Measured another way, it was in excess of 24 cents out of every dollar that we collected for our product. I cite this only to let you know that we pay our fair share of taxes and that is the way it should be in this great country of ours.

With this kind of a showing you would think that everyone would be for the investor-owned utilities in Louisiana and also in the nation as a whole, but this is not the case.

We have for many years been faced with governmental inroads into the utility business. All of you, no doubt, have heard of the Tennessee

Valley Authority and the Nebraska Public Power Districts. Both of these made inroads into the service area of and finally eliminated, with the exception of one small company, the taxpaying, regulated, investor-owned power companies of the areas. There are other examples of this.

The latest move toward further Government ownership of this business is that of the REA, the Rural Electrification Administration, and the rural electric cooperatives.

I want you to know about this movement, how it came into being, and what its aims are. In order for you to understand our fears as to what will be the ultimate outcome, let me review the history of this movement.

Before I do this I would like to call to your attention an article that has recently appeared which voices the same concern that we have about this situation.

There appeared an article in the December issue of Reader's Digest entitled "The REA--A Case Study of Bureaucracy Run Wild." This article presents an interesting factual treatise on this problem. I recommend it for your study and consideration.

Louisiana Power & Light Company has never opposed the Rural Electrification Act as passed by Congress in 1936. The Act authorized the Administrator to make loans in the several states and territories of the United States for rural electrification and furnishing of electric energy to persons in rural areas not receiving central station service. Rural areas were defined as any area of the United States not included within the boundaries of any city, village, or borough having a population in excess of 1,500 inhabitants.

Special subsidies and concessions were given to the rural electric cooperatives to enable them to accomplish this task as it was not an

economically feasible venture. These subsidies and concessions are:

1. Exemption from Federal income taxes;

2. Exemption from practically all state and local taxes;

3. Privilege to borrow money from the Federal Government at the subsidized interest rate of 2 per cent. The Federal Government now pays about 4 per cent for its long-term borrowing.

4. Privilege to borrow 100 per cent of the debt funds required from the Federal Government at the subsidized interest rate of 2 per cent.

5. Exemption from regulation by any Federal authority and in Louisiana from state and local regulatory authorities.

The job of electrifying the farms of Louisiana is just about completed. Louisiana has about 76,000 farms and more than half are served by the taxpaying, regulated utilities. The Rural Electrification Administration states that there are 1.3 per cent of these farms or only 988 in the entire state that do not have service available and that Louisiana ranks eighth in the nation in the number of farms electrified.

Louisiana Power & Light Company currently serves all or part of the electric requirements of 9 of the 13 rural electric cooperatives in the state at one of the lowest wholesale rates of any in the country.

Considerable deviation from the Congressional Rural Electrification Act has occurred -- namely, in the serving of towns and communities with populations exceeding 1500; in the serving of other than farm customers, i.e. commercial and industrial customers; and in the granting of Federal money, or taxpayers' money, for the construction of <u>unneeded</u> generation and transmission facilities at a time when the tax burden for the nation's taxpayers is extremely heavy.

Louisiana Power & Light Company is fully regulated by the Louisiana Public Service Commission at the state level and by the Federal Power

Commission and the Securities and Exchange Commission at the national level. All rates of Louisiana Power & Light Company are subject to the jurisdiction of either the Louisiana Public Service Commission or the Federal Power Commission. The taxpaying, regulated companies are allowed a return on their investment, but they are not by any stretch of the imagination guaranteed a return.

Like any other business, small or large, taxes imposed on a business operation are finally borne by the consumer. It is really a matter of tax equity. Some enterprises manage to escape their fair share of taxes. The rural electric cooperatives are an example of this. With the increasing cost of government at the state and local level, the big question is where will future taxes come from if non-taxpaying businesses are allowed to expand into areas and operations currently being served by taxpaying businesses.

With the subsidies that I have outlined, the rural electric cooperatives, although originated to serve rural areas, have deviated into becoming rural power companies. They have tremendous advantages over those of us who must pay taxes as you do.

The latest move has been for a group of Louisiana rural electric cooperatives to file a loan application with the Rural Electrification Administration for the construction of a small steam electric generating plant near Baton Rouge and some 1,783 miles of transmission lines in Louisiana. This is enough transmission mileage to crisscross the state from north to south and from east to west about five times. With the tremendous amount of money required to finance the growth of an electric utility, this is only a beginning - a down payment on what will be required in the future.

Obviously, with all the power sources and transmission lines now available in Louisiana, such a loan request is not necessary. Such a

project would simple duplicate and parallel existing facilities and would result in the local REA customers having to pay higher rates than they presently pay.

Of more importance to you people, though, are the factors affecting the tax economy.

Such a loan by the Rural Electrification Administration is made at 2 per cent although the money costs the Government 4 per cent. So we all have to help make up the difference in the cost of money.

If the loan is approved, our companies will have unused facilities and reduced income and, therefore, our contribution to Louisiana's tax economy will diminish. And this slack will not be taken up by the Federal Government nor the rural electric cooperatives because neither pays income or appreciable property taxes on its facilities.

I did not come here to cry on your shoulder nor are we looking for any concessions or subsidies. We are desirous of keeping you fully informed of our company's roll in Louisiana economy. If this nationalization movement is successful, in due time our problem will become your problem.

This, in the final analysis, is a problem that you as customers and as people with a stake in this business should decide. We do not believe it should be determined by bureaucrats. I have outlined the position of the investor-owned, taxpaying, regulated utilities here in Louisiana. There have always been adequate quantities of electricity available at reasonable and fair rates and with good service. However, we are unable to compete with the United States Government in this business with all its subsidies, concessions, and advantages. It is our purpose to make sure that you know all the facts with which to make an intelligent decision.

I say that it is time for us to take renewed pride in the American system which has made our country the greatest the world has known. It

is time that we stop castigating ourselves for our shortcomings and start appreciating that the values realized under the American way of life have never been attained by any other system. It is time for us to understand that, over the long term, atheistic communism can never be a match for a society built upon freedom -- freedom to worship God; freedom to choose; freedom to follow one's own star; freedom to excel; freedom not to excel.

I suggest that we, as a nation, pledge ourselves anew to those traits which characterized our forefathers as they founded this country and made it flourish. One of the greatest of these was to be self reliant -- self reliant as individuals and self reliant together as a nation.

I leave you with these memorable words of Emerson in his essay on self reliance. "There is a time in every man's education when he arrives at the conviction that envy is ignorance; that imitation is suicide; that he must take himself for better, for worse, as his portion; that though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given to him to till. The power which resides in him is new in nature, and none but he knows what it is that he can do nor does he know until he has tried."

The future is what YOU make it. Thank you and Good Luck!

MINUTES
OF THE ANNUAL MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

FEBRUARY 6, 1964

The annual meeting of the American Society of Sugar Cane Technologists was held in Baton Rouge, Louisiana, on Thursday, February 6, 1964, at Pleasant Hall on the campus of Louisiana State University and A & M College.

After a period for registration and coffee, the meeting was called to order at 9:40 a.m. by President Pat Cancienne. A few comments about the meeting were made as were announcements about banquet tickets and an invitation to the ladies for the banquet. The program for the Manufacturing Section followed.

Mr. V. J. Bailliet, Chairman of the Manufacturing Section, presented the following program:

1. Vibrating Screens for Sugar Mill Juices, by Mr. Wallis P. Stilz, Manager, Vibrating Screens and Vibrating Feeders, Link-Belt Co.

2. Bridge Crane vs. Revolving Derrick Used for Cane Storage and Mill Feed, by Joseph M. Pugh, J. & L. Engineering Co., Inc.

3. Continuous Centrifugals Operating Problems, by Dr. A. G. Keller, La. State University, and a panel composed of Messrs. W. M. Nuttall of A. Wilbert and Sons, C. N. Presburg of St. James Co-op, and Isasi of Cinclare.

The session was adjourned at 12 noon for lunch.

The afternoon session was convened at 1:40 p.m. During the business session the following actions were taken:

1. Report by President Cancienne that the Constitution and By-laws Committee had no report at this time, but suggested to the incoming President that this committee be continued.

2. Reported that Dr. John Seip would have a formal report for the Summer meeting on Uniform Mill reports.

3. Called to the attention of the membership of the recent deaths of fellow members and paused for a moment of silent prayer for those who had passed away since our last meeting. These included Messrs. Alfred Webre, Sr., Guy A. Poche, W. G. Taggart, and W. Brandes.

4. A financial report was presented by the Secretary-Treasurer (copy attached) and was approved as presented after a motion by Lloyd Lauden and a second by W. S. Chadwich was received.

At this point, Mr. Horace Nelson offered a motion that the Executive Committee be directed to invest $2,000, the place of investment to be left to the discretion of the committee, but stipulation made that the money would be readily available if needed. This motion was seconded by Mr. Ramon Builleaud and unanimously approved.

5. Commendation of Secretary-Treasurer work by President Cancienne.

6. The President presented certificates of membership to Supporting Members.

There being no new business, President Cancienne presented Mr. Paul Cancienne, Chairman of the Agricultural Section, who presented the following program:

1. Present and Future Status of Pesticide Chemicals in Agriculture, by Dr. L. D. Newsom, L.S.U. Agricultural Experiment Station.

2. The 1963 Harvest, Improvements for 1964 and Future Trends in Sugar Cane Harvesting by Marcel Mitchie, Thompson Machinery Co., and L. L. Lampo, J. & L. Engineering Co., Inc.

The meeting then adjourned until the scheduled banquet at the Capitol House, which was called to order at 6:40 p.m. After the blessings before the meal by Eugene Graugnard, the President introduced Mr. Horace Nelson for the purpose of expressing the Society's appreciation and thanks to the sponsors of the social hour. The past presidents who were present were also presented.

President Cancienne then introduced Mr. G. C. Rawls, President of Louisiana Power and Light Company, who delivered a well received address, "A Look Ahead".

After the address Mr. Horace Nelson obtained the floor and moved that a copy of Mr. Rawls' talk be placed in the official minutes. This motion was seconded by Mr. Frank Vought with the further suggestion that the address of Dr. Hunter, Guest Speaker in 1963, also be made part of the minutes. This action was approved. Mr. Richard Glynn obtained the floor and requested permission for a rebuttal by the Electric Co-ops. No action was taken on this discussion.

The 1964 officers were presented. These are:

President	Mr. Warren Harang, Jr.
1st Vice President	Mr. Wm. Chadwick
2nd Vice President	Mr. Paul Cancienne
Secretary-Treasurer	Dr. Denver T. Loupe
Chairman, Agricultural Section	Mr. Ernest R. Stamper
Chairman, Manufacturing Section	Mr. Thomas H. Allen
Chairman at Large	Mr. Frank Barker

Mr. Cancienne expressed his appreciation to the membership for their support during his year as President. In the absence of incoming President, Warren Harang, Jr., Mr. Wm. Chadwick accepted the chair. He offered comments about the past year's activities, commended the past president for his outstanding work and on Mr. Harang's behalf pledged "continued efforts for the continued successful operation of the Society". The annual meeting officially adjourned at 8:20 p.m.

Respectfully submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

MINUTES
OF THE SUMMER MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

JUNE 4, 1964

The Summer Meeting of the American Society of Sugar Cane Technologists was held on Thursday, June 4, 1964, in the American Legion Building, Thibodaux, Louisiana.

The meeting was called to order by President Warren J. Harang, Jr. He acknowledged the excellent turn out and thanked the group for their response and participation in the Society's activities. He presented Queen Sugar, Jo Ann Busse, and her friend Miss Mullin, who were guests of Mr. Kenneth Kahao.

Brief comments and a welcome to Thibodaux were extended to the group by Mayor Leonard J. Toups.

President Harang then presented Mr. Tom Allen, Chairman of the Manufacturing Section for their program which was as follows:

Economic and other Advantages of Increasing Mill Capacity	M. J. McNulty, Manager, Oaklawn Division, South Coast Corporation
Review of 1963 Crop Factory Data	Dr. John J. Seip, Superintendent, Audubon Sugar Factory, L.S.U.
Cane Handling at Glades Sugar House	P. M. McIntyre, Agriculture Manager, Glades Sugar House, Belle Glades, Florida

After a short coffee break, the group reassembled for the program of the Agricultural Section. Mr. Harang presented Mr. E. R. Stamper, Agricultural Section Chairman, who in turn presented the following program.

Sugar Cane Pesticides and Water in Louisiana	Dr. G. J. Lauer, Principal Biologist, Public Health Service, Atlanta, Georgia
Progress Report of Cultivation Tools and Equipment for 1964 (Slide presentation - no paper for publication)	T. A. Thibaut, Lafourche Tractor Company, and Lloyd Waguespack, Waguespack Tractor Company

At the conclusion of the program, President Harang expressed appreciation to the Section Chairmen and the speakers for such an informative program.

Time being of essence, a motion was made by Mr. Horace Nelson, seconded by Mr. F. Evans Farwell and carried unanimously that the Executive Committee be authorized to conduct all of the business due to come before the group.

Meeting adjourned at 12:10 for a social hour which was followed by a lunch at 1:00 p.m.

President Harang called the Executive Committee into session and announced that we proceed with the enactment of all business proposed by the committee at its last meeting.

Mr. Harang suggested and obtained a unanimous approval of the Executive Committee that Dr. Denver T. Loupe, Secretary-Treasurer of our group be our official representative to the International Society of Sugar Cane Technologists Meeting scheduled for Puerto Rico in 1965.

Respectfully submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS
Financial Statement for 1963

Balance in Bank January 1, 1963			$5016.88
Income:			
Dues collected:			
Active Members	$941.00		
Associate Members	140.00		
Supporting Members	560.00		
Foreign Members	35.00		
Total Income			$1676.00
		Total:	$6692.88
Expenses:			
Mimeograph service:			
Printing of Proceedings:			
1962		$ 302.91	
1957-58		441.50	
1959-60		658.50	
Extra papers, etc.		185.63	
Postage (stamps)		164.49	
Stenographic service		228.50	
Office supplies		70.52	
Postal Cards and envelopes		98.10	
Long distance telephone calls		12.18	
Meeting expenses		52.20	
Donation to L.S.U. Foundation		1000.00	
Total Expenses			$3214.53
Balance in Bank (January 1, 1964)			$3478.35
Balance in Petty cash			4.97
		Net Balance (excl. bond)	$3483.32
Government Bond (Face Value)			$ 500.00

MEMBERSHIP

Active Members	265
Associate Members	14
Supporting Members	28
Foreign Members	7
Honorary Members	3
Total	317

Respectfully submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 12 – Papers for 1965

December, 1965

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 12 – Papers for 1965

December, 1965

FOREWORD

This is the twelfth volume of proceedings of the Society which has been published since its founding in 1938.

The first volume published in 1941 included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume published in 1946 included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer, edited that edition.

The third volume published in 1953 included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years of 1950 through 1953. Volume five contains papers for the years of 1954 and 1955. The sixth volume included papers presented during 1956. The third through the sixth volumes were edited by Dr. Arthur G. Keller.

The seventh volume, which is in two parts, 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth, ninth, tenth and eleventh volumes contain papers presented during 1961, 1962, 1963 and 1964 respectively. These volumes, as well as this, the twelfth volume, which includes papers for the year 1965, have been compiled by the writer.

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

December, 1965

INDEX

DIFFICULTIES ENCOUNTERED IN HARVESTING THE 1964 SUGARCANE CROP

by
Ramon E. Billeaud
Billeaud Sugar Factory

Prior to Hurricane Hilda, everyone in our area was estimating that their crops would exceed the record-breaking crop of 1963. Probably, this was true throughout the sugar belt.

Then, along came the 'big blow', and we were suddenly in the position of picking up the pieces, and seeing where we stood. Never before in anyone's memory had a hurricane of such force struck the crop on the very eve of harvest.

It is reasonable to say, then, that we entered the 1964 harvest season with many unpredictables.

As had been our custom for many years, we had been taking maturity tests since early September. We found that, despite the fact that the cane was later than normal in maturity, it was nevertheless progressing satisfactorily. By the 1st of October, the cane was gaining about one-half point per week in sucrose, and we began to plan our harvest.

Of course Hilda changed this.

Immediately after the hurricane, we resumed our maturity tests. We found an immediate drop in sucrose, down to the 8.00 to 9.00 levels. Obviously, our harvest was to be delayed.

Finally, by October 23, the cane again reached desirable sucrose levels of 10.50 and we felt that, although a little lower than normal, it was time to get started. Accordingly, we began our harvest on October 26.

At this time, it was generally felt that a substantial portion of the crop would be lost due to the normal freezes which could be expected in the latter part of the year.

Having begun our harvest, we immediately made several observations with regard to mechanical harvesters:

1. The capacity of the harvesters was greatly reduced because of several factors:

   A. They could operate in one direction only, most of the time.

   B. They had to operate at a slower rate of forward speed.

   C. The operators had trouble making the adjustment to the abnormal conditions.

   D. There was a much greater amount of stoppage due to chocking than usual.

   E. The mechanical break-down time was abnormally high, because of the heavier work being done by the machines.

After several days of trial and error, however, we were able to make certain modifications in the sprockets of the gathering arms which had the result of coordinating the speed of the gathering chains with the forward speed of the machines. Along with this, our operators began to get the feel of the conditions, and consequently, the efficiency of our machines improved somewhat. However, they never operated at a normal rate throughout the season.

Early in the season, we sought to contract on reasonable terms with hand laborers from the St. Landry and Evangeline Parish areas. However, it was not until the latter part of the season that we were able to obtain any of these hand-cutters in quantity. We won't even mention the quality of the laborers at this time. Even then, we had to accede to their wishes and pay them at the end of each working day. Our rate of pay was $8.10 for a nine-hour day, plus $1.00 per day for transportation. When we add normal overhead costs, we can see that the total cost per man approached $10.00 per day. In our heavier cane, they cut

an average of 3 1/2 tons per man-day, amounting to a cost of roughly $3.00 per ton harvested. Ultimately, we had to harvest approximately 20% of our crop at this high cost figure.

This condition, of course, materially affected any profit-motive which we had for the year. In addition, the following conditions adversely affected profits:

1. Although the tonnage of cane was above normal, the actual amount harvested and delivered to the mill was reduced considerably by breaking. This was especially true in the variety C.P. 52-68, where we estimate that we lost three to five tons from breaking.
2. The actual weight per stalk of the cane was found to be less than usual, because the cane was pithy in nature, and seemed to lack the normal amount of juice. However, as the season progressed, this condition improved to a degree.
3. The reduced rate of mechanical harvesting resulted in a higher cost per ton for harvesting.
4. AND, as in most years, the price remained below the price-objective of the Sugar Act throughout most of the season.

These factors, then, all added up to less production than anticipated, less income than anticipated, and much higher than anticipated harvesting cost.

Despite these things, however, our area perhaps fared better than some other areas of the Belt, for these reasons:

1. We were on the Westward side of the Hurricane, and the winds were less damaging in our area. Although our cane was very severely whipped by the winds, they were blown in one direction only. It is my understanding that in many other areas, the cane was whipped back and forth by the changing direction of the winds.

2. Throughout the season, we experienced very little rainfall, and consequently, mud and boggy conditions were no real problem this year.

3. We escaped early freezes, although we did register a bud-killing freeze on November 30. However, up to the last day of our harvest, on January 16, the eyes on the cane remained sound.

With regard to the trash content of the cane this year, as compared to prior years, we noted the following conditions:

Generally speaking, we had less trash. In a large measure, we feel that this was due to the fact that the storm had stripped most of the bottom leaves off the cane. An exception was found in the variety C.P. 36-13, where the leaves adhered very closely to the stalks. Also, trash in C.P. 52-68 was a problem because of the brittleness of that variety. Many tops found their way into the cane stack.

We were bothered very little by rainfall this year, and trash in the form of mud was no real problem.

From the standpoint of varieties, we found that C.P. 52-68 had the greatest amount of trash, followed by C.P. 36-13, C.P. 44-101, and with N.Co. 310 having the least amount of trash. This is undoubtedly due to the fact that N.Co. 310 lends itself well to being picked up by mechanical harvesters.

From the standpoint of the maturity of the crop, we found that we were compelled to start the harvest with slightly lower than desirable sucroses. However, about November 11 - 12, we began to get sucroses in the normal range of 12.00 plus. After this, the sucrose showed a marked improvement, hitting its peak range of 12.75 to 13.25 through the

period December 15 - 16. We then experienced a slight reduction in sucrose, winding up the season in the range of 12.25 to 12.75.

Throughout the season, we noted that the purity ran higher than usual in relation to sucrose. This is noteworthy, because in our particular area, purity always trails sucrose by some margin. We feel that the favorable purity condition this year was brought about by fresher than usual cane. In many instances, the loading equipment was operating immediately behind the harvesters.

As to whether or not the occurance of Hilda will materially change any of our cultural practices, I must say that we plan no major changes at this time. We will possibly dirt the cane more at lay-by time, although again the season will determine this. However, we will lean more heavily on those varieties which are more adaptable to mechanical harvesting once lodged.

In conclusion then, we feel that as bad a blow as Hilda dealt us, it could have been much worse. While we certainly didn't fare out well financially on this crop, we none the less escaped a real disaster on it.

We can only hope that the situation does not repeat itself for another 80 or 90 years.

Thank you for your attention.

HARVESTING PROBLEMS AFTER HILDA

by
Calvin Burleigh
Southdowns, Inc.

I am sure that there were many of us here, who, on the morning of October 4, 1964, wished that we were in some other line of business. Today, four months later, most of us can say that the disaster was not quite as great as we expected, and that it could have been worse.

Our pre-Hilda cane estimate at Houma was for an average of 29-30 gross tons of 4200 acres. We shut down on December 20 with an average of 21.3 tons gross, 19.3 tons net, and about 16.8 tons standard. In other words, a loss of about 30% in tonnage, and a conversion much lower than normal.

The hurricane winds very nearly boxed the compass at Houma, beginning in the north and shifting gradually around through East and South to West as the storm passed. Fortunately, most of the cane went down before the north and northeast winds and stayed down, with a minimum of twisting and breakage except around the exposed edges of the fields. Fields lying away from the highway in lower areas were less damaged than those on lighter soils at the front. C.P. 44-101 suffered the greatest damage from breakage, C.P. 48-103 somewhat less, with N. Co. 310 having the least breakage of all.

Our handmill samples from stubble cane on October 5 gave the following average sucrose results:

C.P. 48-103	11.18
C.P. 55-30	10.30
N. Co. 310	9.91
C.P. 36-13	9.25
C.P. 36-105	9.16
C.P. 52-68	8.85
C.P. 44-101	8.57

C.P. 52-68 on heavy soils averaged nearly a point higher.

We had planned to start the 1964 harvest on October 5. After assessing the damage, and considering the expected heavy tonnage and slow harvesting, we decided to go ahead with the harvesting on October 8, despite the low sucrose figures. Had we known how much lighter than estimated the crop would turn out, we might have delayed a few days longer. Although I feel that a 50 percent payment for the first cane harvested is better than no payment for cane hauled to the woods after a freeze.

I have been asked by the chairman to comment on several specific problems encountered during the harvest. First of all, there were, with a few exceptions, no great differences in the harvesting problems encountered on the various Southdown properties. The condition of the cane was just about the same in Terrebonne Parish, in Lafourche Parish and on the river properties. What differences there were, were due to differences in row direction in relation to the way the cane lodged, and to different variety concentrations. For some unexplained reason, the cane at Salsburg Plantation on the river, yielded 5 to 6 tons heavier than on any of the other properties, although it appeared to be just as badly damaged by the storm and they had just as much trouble with the harvest, and the cane estimate was not much different.

At Houma, as elsewhere, the greatest problem was with cutting the cane and scrapping behind the harvesters. We had eleven machines available for use at Southdown, four J & L self-propelled machines, two Thomsons with pickup attachments, and five Thomsons with fixed front ends. We had three of the older Thomsons converted with LaRose pickup attachments as soon as the crop damage became apparent. We actually operated only eight of the harvesters on a full time basis, four J & L's and four Thomsons, and used the remaining three Thomsons only occasionally in the more erect

cane. I would estimate that we worked an average of 13 to 14 hours per machine per day to cut about 150 tons. This is only about 1/3 to 1/2 the harvesting rate possible with the same machines in erect cane. Of course, it was a rare day when even one or two of the machines worked a full day without some lost time for repairs.

Lights were installed on all the machines and we operated some of them on a two shift basis during part of the harvest. The quality of the night work was not generally as good as the day work; although, where we were able to use good operators, on a shift basis, under adequate supervision, there was little difference in the work done. Too often, the night work had to be done with a tired operator and a tired overseer after the regular hours, and this is unsatisfactory at any time.

The scrap was very heavy, as you all know, and we never did have enough scrappers to do a thorough job. Unfortunately, the heaviest loss was in the more badly damaged fields along the highway where the mess shows off to the best advantage! I would estimate that the scrap left in the field would average out at about three tons to the acre. During the first weeks of the harvest, it would have cost more to recover than it was worth at the mill; during the last week or two our scrapping crews had dwindled down so that we could not begin to keep up.

Our labor cost for cutting and scrapping behind the harvesters averaged out to $.568 per ton for the crop. This compares rather unfavorably with the figure of $.167 per ton for the 1962 crop, the last crop we had with reasonable erect cane. We did not do any hand cutting this year.

The only real problem encountered in loading and hauling the crop was the very light loads due to crooked and lighweight stalks. We hauled most of the cane with three wagons behind each tractor, even old U.C. tractors, and seldom averaged the tonnage with three wagon loads that

we made in 1963 with two wagons. The same was true for the cane hauled in trucks, it took three loads to deliver the tonnage hauled in two loads in previous years. Our labor costs for loading and hauling averaged \$.278 per gross ton compared to \$.202 in 1962, and the cost of hoisting and loading trucks went from \$.091 in 1962 to \$.121 in 1964. As a final comparison, our total labor cost per net ton averaged \$1.015 in 1964 as compared to \$.476 in 1962.

Repair and maintenance costs were also much higher on the harvesters, although the loading and hauling equipment required less attention than usual because of the light loads being handled. The harvesters operated about double the hours normally required, with a much greater load on the pickup assemblies, chains, sprockets, and gear boxes. Our total repair costs for harvesters and loaders in 1964 was approximately 2 1/2 times the amount spent in 1962. This, of course, reflects some increase in the cost of wages and parts, but is largely due to the longer hours of operation and greater wear. In an effort to cut down on the lost time, we put one mechanic in the field with orders to check over each machine at least once a day to try to make minor repairs before major breakdowns could develop. We feel that this saved us a lot of lost time.

C.P. 52-68 was by far the worst variety to harvest this year. It was extremely brittle with long, light, crooked tops and many uprooted stools in heavier cane. Slightly over half the crop was in this variety. N. Co. 310 was badly lodged, trashy, and difficult to cut, but handled better than C.P. 52-68 because there was much less breakage in harvesting. There was apparently less weight loss with N. Co. 310 than with C.P. 52-68 and fields of N. Co. 310 yielded closer to the pre-crop estimates. C.P. 44-101 fields despite greater damage from the storm, broken tops and sprouting eyes, was the easiest variety to harvest. Because of the low

sucrose level early in the harvest, C.P. 44-101 fields were harvested late and had more time to straighten up. We were able to cut much of it, even plant cane, without down cane pickup attachments. Many fields of C.P. 44-101 yielded quite close to the earlier estimates.

Our cultivation plans for the 1965 crop will not be greatly affected by the hurricane damage. We were fortunate in having relatively good weather throughout the harvesting period and, as a result, have only a small acreage of rutted and cut up stubble to repair. We do have a lot of long stubble and trash to dispose of and our plans call for shaving nearly all of the stubble and an extra round of early cultivation with disc choppers to break up and incorporate some of this trash. Additionally, we plan to apply a little heavier dose of nitrogen at fertilizer time to aid in rotting the trash and to insure an adequate supply of nitrogen to the new crop. Other than a concentrated effort to hold all cultivation costs to a rock bottom minimum, no other changes in cultivation work are planned.

THE EFFECTS OF HURRICANE HILDA ON THE SUGARCANE HARVESTING OPERATION IN ST. MARY PARISH

by
Minus J. Granger
County Agent

The year of 1964 will long be remembered by all farmers and other individuals throughout the Sugarcane Belt. Hurricane Hilda, with winds recorded at over 120 miles per hour, hit the cane belt on October 3, including St. Mary Parish.

Hilda left its ruins, including the heavy breakage of sugarcane, flattening of sugarcane to the ground, beating cane to such an extent that resulted in shredding of leaves and de-rotting a large percentage of cane. October 7, a general meeting of all cane growers was called with at least 95 percent of the cane growers present. The general condition of the crop was explained and all growers encouraged to harvest as much of the crop as possible. Growers were told that there was very little assistance available other than to start harvesting when time came and to get their crop to the mills.

On October 16, a couple of mills started grinding and by October 26, all the sugar mills were in operation. At first, sucrose and purity was rather low but improved gradually about 3 to 5 weeks later. In general the weight of the cane was light throughout the season.

Through hard work, trial and error, most of the cane growers in St. Mary Parish were able to cut their cane by machinery. Very little of the cane acreage was cut by hand. If an estimation would be made, it is doubted if over 20 percent of cane acreage was cut by hand.

The cost of harvest per acre just about doubled as compared to a normal season. This was primarily due to the increase labor used for scrapping.

It is estimated that growers of St. Mary Parish lost about 25 to 30 percent of their cane crop from damages caused by Hurricane Hilda. The 1964 farm gross income from sugarcane will be about $6,375,000 as compared to about $10,000,000 in 1963. Lower farm gross income is primarily due to damages caused by Hilda and lower prices received for sugar. The expected average yields per acre in standard tons for 1964 will be about 21, this compares to 32 in 1963.

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

Douglas P. Stevens, Jr.
Cinclare Central Factory

1. What are the plans for handling both plant and stubble cane in relation to cultivation as of February 4, 1965:

   (A) Plant Cane: Aerial application of 1¼ lb. Silvex about February 15. This will be followed with off-barring and throwing back, with tandem choppers, immediately following with 6 qt. Fenac with the ground spray rig. We will fertilize with NH_3 and dirt the cane at the same time. From here on, probably just work the row and wrap it up using 3-row single choppers.

   (B) Stubble Cane: Where the stubble is not pulled up too bad, we are going to clean off the row with shavers. We plan to off-bar with choppers and will be working a wider drill this year, about 4 inches wider than normal, because the ratoon was pulled to one side of the row and is not in the center and not in a straight line.

   In the areas that were harvested during wet weather, we plan to leave the cane on the off-bar and build back the row when we fertilize. On the other areas, we plan to off-bar and throw back the row to maintain maximum drainage and also for ease in spraying.

2. How extensive was the damage to stubble (for this year) from Hurricane Hilda?

   (a) Per cent of stools with exposed roots.

   (b) Amount of stubble severely injured or pulled from the ground during harvest.

(c) What changes in cultivation do you intend to do to care for the uprooted stubble stools.

Up to now there doesn't look to be much damage to the underground eyes except, of course, those eyes on and near the top of the ratoon (exposed side). The stand looked very good up to the 16th of January, at which time it was killed back again. However, recent inspection showed sound eyes as shallow as 1/2 inch within the cluster of stubble that is exposed.

I would say that 35% of the stools were pulled out of the row to some degree by Hurricane Hilda with up to half of the roots being exposed on some stools.

Percentage wise, only a small amount of the stubble was pulled out of the ground by the harvesters. This was due to the lack of experience and lack of constant concern of the harvester operators in practically every instance. The better operators had to adapt and adjust their machine differently for practically every different cut of cane they went into in order to even attempt to do a good job under the circumstances. The amount of stubble severely injured probably will not be completely detectable until the cane suckers. There could be a late penetration of some primary shoots in turn, causing a late or longer period of suckering, depending upon variety.

All our off-barring will be done with reversed choppers using new scalloped blades. We feel that it will be necessary to have a wider drill by 4 to 6 inches, because of the cane laying all over the top of the row. The ground spray rigs will be set to give a complete cover of material to this wider drill too. In some cases we might have to do some early dirting of the cane if it looks like we might lose the stubble that germinates from the uprooted stubble stocks without any soil to

root in. This could cause some change in the herbicide program because of putting new dirt on top of the drill.

3. Were there any differences in handling of varieties in harvesting of sugarcane following Hurricane Hilda.

At first, all the cane was very brittle and there seemed to be very little, if any, difference between varieties. After about the third week, we found that we could do a much better job and have easier cutting in the N.Co. 310 and 52-68, if we could cut it at all. Generally, in these two varieties the heavier the yield, the harder to cut. 44-101 was disappointing in that it remained very brittle for a long time and was breaking in two alot. 36-105 and 47-193 was the hardest to cut and in a lot of acreage, where it was not completely down, we were unable to cut it, even after burning the cane ahead of the harvesters. 48-103 was somewhat of a different story. Although it was the best testing cane at the beginning, we did not do a good job in cutting it mainly because it was in this variety that we had to learn how to cut severely lodged cane. This was a new and very hard fight to most of the operators and it took them about three weeks to either learn how or leave.

4. What was the greatest loss from Hurricane Hilda?

(a) As its affect on quality of cane.

(b) Cost in handling in the field.

(c) How was the sugarcane different from a normal year?

Hilda hit the cane so hard and so quick that it not only threw it back into a negative state of growth from a maturing state of growth, but it disrupted the physiological function of the plant. In a sense, the cane didn't know whether to start growing again or start maturing again. As a result, it lost a lot of its weight and the brix, or start sucrose and purity in the samples were completely out of balance and on

top of this, the broken top stalks scattered through out the cane weren't helping matters any. The cane improved at about a normal pace after October, but because it started out so low and was actually growing at first and for so long, we were unable to reach an above par level in Brix, Sucrose and Purity for any length of time during the remainder of grinding. There was one other thing that affected cane quality. It was very hard to maintain any uniform height in topping the cane because of the way it was lodged. In some cases we had no control over where we topped so naturally this played a major role in quality of cane to the mill.

The cost of handling in the field was much higher than normal. The light weight of the cane alone was enough to add 20% additional cost to handling. Trucks carrying 20 tons of cane in 1963 were doing good to get 15-16 tons on a load in 1964. Yet, they still carried about the same volume of cane stalks and the trucks were just as full with the same number of bundles. Rail car loading was the same thing. This lack of weight problem plus the low sampling qualities of the cane at the mill was affecting our cost of handling throughout the field operation. One scrapper would have to save about 1-1/3 tons of <u>par cane</u> to balance out a days wage with the $6.00 sugar we were faced with.

Other than the fact that all the cane was abnormally brittle at first, the biggest difference from a normal year was that we were unable to follow the normal procedure in harvesting by varieties as they matured, first in the stubble than in the plant cane. We were constantly taking special samples and they would vary from cut to cut, within a variety. This caused the harvesters to jump about in the fields trying to cut more matured cane when possible, if we could cut it.

5. Out of curiosity, after Hilda, we wanted to know and follow the change in the difference between cane that had broken tops compared to cane with normal tops. So, at weekly intervals, we took like samples of damaged cane and normal cane in three varieties from the same cut and in the same general area until the cane was cut. In all weekly samples, the damaged or broken top sample tested lower in brix, sucrose and purity. The average of all the weekly samples is listed below:

36-105	Plant Cane:	Brix	-	1.26
		Sucrose	-	1.66
		Purity	-	5.46
52-68	Plant Cane:	Brix	-	1.16
		Sucrose	-	1.88
		Purity	-	6.92
N.Co. 310	Plant Cane:	Brix	-	0.69
		Sucrose	-	1.33
		Purity	-	4.79

SAVOIE FARMS, INC. MOSAIC CONTROL PROGRAM

by
Raymond Blanchard

The following is a summary of the Savoie Farms, Inc. roguing program for the control of mosaic in sugarcane:

Crew (Roguing)
1 Foreman (school teacher)
6 to 9 Laborers

Wages
$2.00 per hour - foreman
$1.00 per hour - laborers

Method of Roguing

a. One man per row

b. Diseased cane dug out with shovel

c. Rogued after school - 4:00 p.m. to 6:00 p.m. and 7:00 a.m. to 12 Noon during vacation

Date of Roguing

First roguing started in the middle of April when cane was tall enough to identify mosaic

Second roguing was approximately one month following the first roguing

Third roguing was in the latter part of June

Results

Mosaic Infestation Per Variety Per Year

Variety	1961	1962	1963	1964
44-101	61 acres .44%	68 acres .49%	65 acres 1%	67 acres 1.1%
N.Co. 310	21 acres .41%	38 acres .86%	14 acres 1.9%	Too high
52-68	36 acres .24%	61 acres .87%	72 acres 1.3%	48 acres 4.8%
48-103	Trace	Trace	Trace	55 acres .22%
55-30				20.13 acres 2.7%
Cost per Acre Roguing	$2.08	$2.35	$2.51	$2.87

Remarks

1. Foreman supervised and checked laborers' work.

2. All plantations did not have the same amount of infestation.

3. The number of mosaic stools rogued decreased with each time of roguing within a season (example, 1st - 100 stools; 2nd - 75 stools; 3rd - 25 stools).

4. In 1963-64 an experiment was conducted using 6 cuts of 55-30.

   a. Three cuts were rogued once in the fall and again in spring.

   b. The other 3 cuts were rogued in the spring only. (The first spring roguing.)

   The results were as follows:

   a. The cane rogued in the fall and again the first time in the spring had a combined total of 208 stools.

   b. The cane rogued in the spring only had 1194 stools in first roguing.

5. The mosaic infestation was greater near a line of vegetation, especially bamboo.

MOSAIC DISEASE SITUATION IN ST. MARY PARISH

by
Minus J. Granger
County Agent

For the past six years, cane growers from St. Mary Parish have been planting approximately 75 to 90 percent of their cane acreage to C.P. 44-101, N. Co. 310 and C.P. 52-68. All three of these varieties have given satisfactory results in yields. In the last two to three years N. Co. 310 has not given satisfactory stands in stubble cane in some of the areas in the parish. In years past, when droughts occured, yields of C.P. 44-101 have also been affected.

In the year of 1959, mosaic was found in only a few cases in the parish. During the month of April, 1959, agents from throughout the cane belt met in St. Mary Parish, along with representatives from the Louisiana Experiment Station and the specialist in sugarcane from the Louisiana State University Agricultural Extension Service. The purpose of this meeting was to adopt a uniform program of roguing in an effort to control the mosaic disease.

In May of 1959, six field meetings were held in the various areas of the parish for the purpose of teaching cane growers the identification and methods used in roguing for mosaic. In the selection of specific farms for field meetings, it was difficult to locate even one cane stool affected with mosaic. Several farms had to be checked in all areas before one or more cane stools could be found with mosaic. In most cases, the only variety where only a trace could be found was in N. Co. 310. However, mosaic was found in a very few cases in some of the other varieties, but only in traces.

At all of the field meetings, growers were encouraged to rogue their sources of seed cane at least four times. Follow-up visits were made and

fields spot checked for mosaic in an effort to convince growers to rogue sources of seed cane.

The following year, 1960, the mosaic disease started to show up more frequently in all of the three major varieties, C.P. 44-101, N. Co. 310, and C.P. 52-68, but still in traces only except in some very few isolated areas where 1 to 2 percent was found.

During the month of May, another series of seven field meetings were held for the purpose of teaching growers the identification and methods used in roguing for mosaic. There was an over-all attendance of 80 growers present at all of the seven meetings. Every grower present at these meetings expressed his intention to carry out recommendations for roguing mosaic.

It was the intention to have every grower in the parish to rogue his sources of seed cane. Several farm visits were made, radio and TV programs presented, circular letters sent to growers, and news articles written in an effort to stimulate interest among growers to control mosaic in their sources of seed cane.

In the early spring of 1961 several fields of sugarcane were spot checked for mosaic, including some of the cane that had been planted from cane rogued the previous year. In most cases, mosaic was found from a trace to 2 percent in cane planted from rogued cane and up to 30 percent in the varieties of C.P. 52-68 and N. Co. 310 which were not rogued. During the middle part of May a series of four (4) field meetings were held to continue stressing the importance of roguing sources of seed cane and to present the status of mosaic at that time. Roguing demonstrations were also given at each field meeting. There were 42 growers present at all of the four meetings. Growers had 86 percent of their cane acreage planted to the three previously mentioned varieties which are susceptible to mosaic. Again an all out campaign was made

to encourage growers to continue roguing their sources of seed cane. It was estimated at that time that at least 30 percent of the cane growers were roguing their sources of seed cane.

In the spring of 1962, growers were encouraged to continue roguing their sources of seed cane whenever it was economical to do so. The mosaic disease by that time had taken over and was so heavy in some of the areas that in some cases it was not economical to rogue sources of seed cane. This was especially true in some fields of N. Co. 310 and C.P. 52-68 and in several areas, C.P. 44-101 was included in the areas too heavy to rogue.

It was felt that N. Co. 310 was the source of mosaic by personnel from both the U.S.D.A. Station and Louisiana State University. It had been pointed out before and was highly recommended that cane planted as a source for seed, should be isolated from N. Co. 310. This was encouraged in St. Mary Parish through field meetings, personal contact and other media.

In 1963 and 1964, field meetings were continued for the purpose of showing how to identify mosaic, methods of roguing and to present the status of the mosaic situation in the parish. In most cases, mosaic was so wide spread in the parish in 1964 that only a few farmers could actually rogue their sources of seed cane of these three varieties.

The variety C.P. 55-30 which was released in 1963 and checked in 1964 resulted in the following: during the month of May the cane had an average infestation of 18 percent and in June the infestation had reached 19 percent. In most cases where the mosaic infestation of this variety was 4 percent and above, the adjoining varieties were highly infested with mosaic.

CONCLUSION

Whenever sources of seed cane can be economically rogued, roguing will be recommended. Isolation of cane to be used for seed will continue to be recommended, especially away from N. Co. 310 or any other variety with a high mosaic infection. Growers will be encouraged to continue the consideration of planting the present minor varieties which are less susceptible to mosaic.

At the present time growers have not experienced too much lost in yields which can be directly attributed to mosaic. It is hoped that they never do. This, in my opinion, is the main reason why so many growers are not following a complete roguing program and other recommendations to control mosaic.

On some farms where a good roguing program has been followed, mosaic can still be controlled at least to a minimum. This is especially true for the growers who are not planting N. Co. 310 and keep their sources of seed cane away from N. Co. 310 and other highly infested varieties.

In the last four years, seed cane that had been rogued and free of RSD was made available through the American Sugar Cane League committee. This program has meant a lot to several growers in the parish, especially small growers who cannot afford to heat treat their own seed cane.

It is understood that this seed program has been discontinued. However, a similar program should be considered by individual parishes if it is possible.

We, in St. Mary Parish, like agents in other parishes in the cane belt, will continue to follow recommendations as given by the research personnel from U.S.D.A. and L.S.U. so growers can keep mosaic disease to a minimum.

GATKE MOULDED FABRIC BEARINGS ON SUGAR CANE JOURNALS AND AUXILIARY EQUIPMENT

by
N. Radloff
Gatke Corporation

presented by
A. W. Norman
Voorhies Supply Co., Inc.

Mr. Chairman, ------- .

The use of non-metallic bearing liners in sugar mill journals is not particularly new, however, it is only in the past three years that a sustained and completely successful effort has been made to use such liners in regular production. The files of the Gatke Corporation, who are the originators and manufacturers of these liners, show that the first actual use was in a Cuban sugar operation during the 1948-49 seasons. Two liners were installed in a special mill known as a Kopke mill, which was dismantled after the second season due to other operational difficulties, although the liner and the journal were in perfect condition. Unfortunately, with the dismantling of the mill, the successful application of the bearing liner went unrecognized.

To those not familiar with the material, it consists of specially woven cloth saturated with a phenolic laminating resin, and then moulded under heat and high pressure to the required size and shape. Special moulds have been developed to assure uniform high density throughout the finished product. The physical properties of this material are as follows:

Compressive Strength	40,000 to 43,000 p.s.i.
Tensile Strength	11,000 to 13,000 p.s.i.
Shear Strength	10,000 to 12,000 p.s.i.
Flexural Strength	20,000 to 23,000 p.s.i.

By comparison, the normal babbitt material used has a compressive strength of 12,000 to 15,000 p.s.i. and cast brass 20,000 p.s.i. at its proportional limit.

This material is a heat insulator, having a thermal conductivity of .17 BTU/Hr./Sq. Ft./^{o} F./Ft. and for this reason requires cooling water applied directly at the journal and bearing surface. The edges of the liner are chamfered to collect the water and allow it to drain into a receiving pan away from the mill rolls. Water jacketing of the quarter boxes or chairs is not required, as there is no opportunity to transfer heat through the liner. The amount of water used with this liner is considerably less than what is normally used for a water jacketed bronze or babbitt bearing.

Lubrication of the Gatke liners is provided by a suitable oil or grease, introduced directly into the bearing or on the journal. The lubricant should be of a type that will allow the creation of a lubricating film under extreme pressures and water conditions, but at the same time will not cake or harden so as to cut off water flow. There are several excellent lubricants on the market that fulfill these requirements. An oil groove or chamfer is usually provided before the pressure area, and the flow should be such to assure an adequate supply of the lubricant. Coefficient of friction varies with loads, journal finish, speeds and lubricant temperature, but is generally in the range of .05 to .09. While the liner material does not absorb oil or grease, it has been demonstrated that a film will remain on the surface even when the supply of lubricant is cut off.

Installation of the liners can be made to existing quarter boxes by direct replacement or by machining a recess to receive a liner of

5/8 to 3/4" thickness. The majority of the liners installed to date have been approximately 180°, however, since the effective bearing area is probably no more than 150°, it is recommended that a liner of 160° to 170° be used in future installations wherever possible. In all the present installations dowel pins of the same material have been used to hold the liner in place, however, it would be possible to machine the quarter box so as to have a lip of metal retain the liner on the mill side and use brass keeper strips bolted to the box on the other three sides. This arrangement would considerably reduce the number of dowels, if not eliminate them altogether.

The first of the current installations was made in September, 1961, at the Olokele Sugar Company in Hawaii, on the off-side of the discharge roll of No. 4 mill. This installation was the subject of a paper presented to the Hawaiian Sugar Technologists Meeting by Mr. W. S. Patout, III, in November, 1962. At the time of the report, the liner had been in operation 3,585 hours with 389,000 tons of cane crushed. The installation was using only 1.5 gallons per minute for cooling water in contrast to the 4 to 6 gallons per minute that were required for the other bearings in this mill. Examination at that time revealed that the liner and the journal were in excellent condition.

The first installation in Louisiana was made in late 1962 at Sterling Sugars, Inc. on the discharge roll of No. 5 mill on a 17 x 23 journal. During the 1963 season this mill ground a record of 408,000 tons and inspection at the end of the season revealed both liner and journal to be in perfect condition, with no apparent wear.

This installation was reported in the Louisiana Sugar Journal of December, 1963, and Mr. Charles Avrill, Chief Engineer of Sterling, advised that the Gatke liners operated considerably cooler than any other bearing,

and also used less water and lubricant than any other bearing in the mill.

During the 1964 season, installations were made in a number of sugar mills and in one cane crusher in Louisiana. In each instance the liners were doweled to the housing and a metal keeper strip was also used. These mills are as follows:

Billeaud Sugar Factory
1 liner for 16-5/8 x 22" journal
1 liner for 16-3/4 x 22" journal

Louisa Sugar Co-op, Inc.
2 liners for 16 x 22" journal
2 liners for 16-3/8 x 22" journal

Sterling Sugars, Inc.
4 liners for 16-1/4 x 24" journal
(This is in addition to those previously mentioned)

M. A. Patout & Sons, Ltd.
Installed by Dibert, Bancroft, & Ross, Ltd.
2 liners for 18 x 26" journal

Dugas & LeBlanc, Ltd.
2 liners for 15-7/16 x 20" journal
2 liners for 15-3/4 x 20-1/2 journal (these particular liners were made with a thrust flange or collar at each end).

Albania Sugars, Inc.
2 liners for 16-3/4 x 20" journal (this installation was on a two-roll crusher)

All the foregoing organizations have graciously given permission for the use of their names and have allowed us to say that thus far the installations appear to be completely satisfactory.

A more definite appraisal will be made when the mills are dismantled and all parts inspected. Detailed information can be included in future reports to this society.

Gatke Bearing Liners have not yet been used on the top rolls of sugar mills. The use of Gatke Bearings on the top rolls presents a considerable problem because of the floating action of the top rolls

and the difficulty of applying the cooling water to the mill journals.

In a discussion with Mr. Charles Avrill, Chief Engineer of Sterling Sugars, Inc. at Franklin, Louisiana, we talked about the feasibility of using Gatke Liners on top rolls and Mr. Avrill expressed the opinion that he did not feel that the method of introducing the water to the journal was an insurmountable problem and he proposed to use Gatke Bearing Liners on top roll journals when he needed to replace those bearings in the future.

In summary, the use of the Gatke Moulded Fabric Liners in cane mills and crushers provide a number of direct and indirect benefits;

1. Its direct cost is substantially less than that of an equivalent babbitt or bronze liner.
2. The weight of the material is 1/6 that of bronze and can easily be handled by one man in less time than a metal liner.
3. Being non-metallic, it cannot gall or score journals and with an elastic modulus of approximately 1,000,000 it is sufficiently resilient to allow for some degree of self-alignment. This characteristic also allows it to absorb high shock loads without permanent deformation, and without cold flow.
4. The quarter boxes or chairs do not require water jacketing which reduces their cost, and also eliminates the maintenance expenses required to prevent water leakage.
5. The installation uses less cooling water and lubricant than is used by a metal bearing. The lower friction of the liner results in a reduction of the power requirements.
6. If accidentally all lubrication and cooling systems fail simultaneously, the liner will still not score or seize the

journal and, furthermore, the operator will be immediately warned by a distinctive pungent odor which is given off by the material at excessive temperature. This enables corrective action much sooner than would be possible with a metal liner.

The Gatke Moulded Fabric Bearing has a long history of successful service in heavy duty applications outside the sugar industry. Steel rolling mills the world over use these bearings in essentially the same manner as outlined in this paper. They are also used in ore crushers, large grinding mills, diesel locomotives, ships and in an endless variety of construction equipment.

Within the sugar industry, in addition to mill journal bearing liners, these bearings have been widely used for many years in screw conveyors, both on raw and refined sugars in wet and dry service and on filter press mud conveyors. They have been used as bushings on wire rope sheaves of cane derricks, both at the factories and in the fields. They have replaced babbitt in pillow blocks, on return idler shafts of main cane carriers, on head and tail shafts of intermediate carriers and in countless other pillow block applications. We have also used the material as wear strips on juice drags and cane tables by cementing the strip directly to the metal members. Results have been excellent. Generally, the material can replace babbitt or bronze with improved performance and wearing qualities in various types of bearing applications in sugar processing equipment.

It is hoped that this presentation will stimulate further thinking and investigations on sugar mill and crusher bearings and it is further hoped that the many advantages offered by Gatke Moulded Fabric Liners will lead to their wider acceptance and usage in the industry.

We would be less than gracious if we did not express our deep appreciation to our many friends in the engineering departments of sugar mills who have accepted our assurance that Gatke products would render satisfactory service in their mills in very many applications. We must express our extreme gratitude to Mr. Charles Avrill, Chief Engineer of Sterling Sugars, Inc. at Franklin, Louisiana who installed the very first Gatke Sugar Mill Journal Liner to be used in a Louisiana Mill and to the management of his company for their confidence in the judgement of Mr. Avrill and ourselves. Both Mr. Avrill and Mr. Thomas H. Allen have told us of their satisfaction with Gatke products.

If there are any questions or comments, I will be glad to hear from you, or answer as many as time will allow. Thank you.

APPLICATION OF "STEARNS" MAGNETIC SEPARATORS
IN
SUGAR CANE MILLING

by
Wm. J. Bronkala
Indiana General Corporation

INTRODUCTION

Sugar cane millers have long been aware of the damage that tramp iron can do in their plants. With the increased use of mechanical harvesting and cane handling equipment, this tramp iron problem has become more serious than ever before. The crushing roll damage caused by tramp iron is quite evident when the rolls are inspected. Critical down time and maintenance and repair costs are the primary compulsion which leads cane millers to the installation of tramp iron removal equipment in the form of magnetic separators. A factor that is not as readily evident is the loss of sugar extraction in plants where heavy tramp iron damage has been sustained. It would also seem that serious accidents might occur when tramp iron gets into the mills and magnetic protection will prevent such accidents.

The savings affected in maintenance alone will in most instances repay the cost of the magnetic tramp iron removal equipment within 3 to 5 years time. No studies have been made as to improved sugar extraction but obviously this makes tramp iron removal even more attractive. Extraction reduction would be expected to be proportional to amount of roll surface damaged.

BASIC MILLING PROCESS AND FACTORS RELATING TO MAGNET APPLICATION

The writer does not consider himself to be an expert on sugar cane milling but was fortunate to be able to inspect a number of Louisiana sugar mills recently. The basic process observed was very similar in

all mills and is shown in Sketch #1. Two of the mills inspected had installed tramp iron removal drums in the position shown in the dotted section.

Several factors affecting magnetic separator selection and installation were noted. The cane is fed at a somewhat irregular rate to the primary cane carrier. A set of cutting knives rotating at about 550 R.P.M. reduce the cane to a smaller size. Since no tramp iron removal is attempted ahead of the knives, the presence of large tramp iron can cause the knives to break off and they will move with the cut cane to the primary crusher. The condition of the cane will vary, depending on field conditions, and a slight variation in the cut cane condition does develop.

The loading of the cane conveyor is quite deep. After the knives, the load will usually be between 18" and 36" deep as it goes over the head end of the carrier. The carrier moves at a slow speed and after cutting the cane, is quite damp. Discharge from the head end of the carrier is difficult to control and is influenced by the knife action, condition of the cane, and the feeding of the cane onto the carrier by the cane tables.

In the milling operation, the cane moves through a series of crushing rolls which vary in face configuration with the roll setting progressively reduced at each succeeding mill.

When considering a magnetic separator for effective tramp iron removal in this service, the following points should be noted:

1. Cane loading is deep. Any magnet installed must have a deep field pattern to effect maximum tramp iron removal.
2. The cut cane is mat-like and interferes with movement of the tramp iron as it is attracted to the magnet face.
3. The shape and size of the tramp iron varies widely. Since the last roll setting will be in the 1/2" range or finer, all tramp coarser than this size must be removed.

4. The installation point for tramp iron removal should be just ahead of the first roll. It would be desirable to have tramp iron removal of the large tramp ahead of the knives so as to protect them against damage, but to date a suitable magnetic device to accomplish effective tramp removal at this point has not been developed.

MAGNETIC SEPARATOR SELECTION

The magnetic separator we have recently introduced for more effective removal of tramp iron is the "LD" magnetic drum. Previous to 1960 the tramp iron magnet most frequently used in sugar mills was the spout or plate magnet. These units were installed in and/or above the chute leading to the first roll. Spout separators have several limitations:

1. The depth of magnetic field obtained is insufficient to protect through the full burden on the magnet face.
2. These spout magnets are static separating devices which collect the tramp iron on their face. They require periodic interruption of the feed for manual cleaning.
3. Collected tramp iron interferes with cane flow.

With the development of the "Stearns" Type "LD" magnetic drum, we obtained a heavy duty unit that could stand the rough service encountered in sugar cane milling while developing a field pattern that would more effectively cover the normal cane loading. It also provides an essentially automatic operation since the tramp iron is continuously discharged.

The internal design of this unit is shown in Sketch #2. The magnet assembly is held in a stationary position by clamp bearings and the cylinder is driven around this assembly by means of a sprocket and chain at a speed of from 25 to 35 R.P.M. Pole design is such as to provide a large collecting surface and to orient the longer pieces of tramp iron so that they will not jam or be knocked off the shell.

Principle of operation is shown in Sketch #3. The unit is top fed and the relatively high surface speed thins the load as the cane passes through the influence of the magnetic field. This drum speed also serves to throw the non-magnetic cane from the shell surface.

The magnet field developed by the "Stearns" 36" diameter "LD" drum produces a field of 300 gauss at 13" from the drum face. The surface holding force at the drum surface is in the 1700-1800 gauss range. Deeper field patterns are available on larger diameter "LD" drums. This type of field will secure effective removal of both large and small tramp iron.

To insure dependable operation, the "LD" drum incorporates an "O" ring seal on a machined head giving a watertight drum. A 1/4" manganese steel cylinder insures satisfactory operation in this rugged cane handling service.

PLANT INSTALLATIONS

Two installations of this "LD" drum separator have been made in Louisiana sugar mills. The first made in 1961 was at St. Mary's Sugar Co-op. Two barrels of tramp iron were removed in the first season it operated and removal during this last season is shown in the next slide. This plant uses a unique installation of the second set of knives just ahead of the magnetic drum which serves to produce a smoother and thinner feed to the magnet. This is the preferred type of installation.

The second installation made during 1964 was at Iberia Sugar Co-op. and the next slide shows the tramp iron removed this season. Feed to this unit is direct from the head end of the carrier and has greater fluctuation in depth than at St. Mary's. This condition would lead us to suggest that when the drum type magnetic separator is installed, the possibility of positioning a set of knives near the discharge end

of the main cane carrier should be considered. If the expense of this change is beyond the money appropriated, a leveler should be installed at the discharge of the carrier to insure that all cane is brought within range of the magnetic field.

SUMMARY

The introduction of the "LD" drum in existing sugar cane milling plants has shown that a better removal of tramp iron can be obtained. Proper installation of the drum insures virtually complete tramp iron removal.

SOME IDEAS AND REMARKS ABOUT EVAPORATION

Carlos M. Alonzo
Duhe & Bourgeois Sugar Company

A lot has been written about evaporators in the sugar industry, but we believe that much more should be said about this subject. In order to clarify and amplify these, we would like to present some of our observations in this matter.

It is our desire that someone could work over these ideas and develop them in favor of Sugar Technology.

ENTRAINMENT

POSSIBLE CAUSES OF ENTRAINMENT AND HOW TO PREVENT IT

We first want to examine a problem that has always existed in evaporation, but which is getting worse every day. As it is generally known, entrainment is mainly produced in the last body of the evaporators. We have found that some separators or catchalls, which were very efficient several years ago, are no longer achieving their task. With this in mind we have arrived at the following conclusions, which we would like you to consider.

Approximately 15 years ago a 9 foot diameter evaporator did not have more than 3,000 sq. ft. of heating surface. It was common practice for the tubes to be 1 3/4" or 2" diameter, spaced 3/4" to 7/8" apart, and 48" to 54" long. The downtakes were generally 30" in diameter.

An evaporator as described above has an actual free space above the calandria, or liquor belt, of approximately 11 feet in height. The evaporation rate of a triple effect, for instance, was seldom better than 9 pounds per sq. ft. of H.S. per Hr., with a 25" vacuum and had very little non-condensable gases.

Today this practice has greatly changed. Sometimes due to lack of room or even with the purpose of re-using the same body, it has been possible to build a 9 foot diameter evaporator body with 5,500 sq. ft. of heating surface. To accomplish this, 1 1/2" diameter tubes are used, spaced 3/8" apart in copper bearing steel tube sheets and 1/2" apart when copper tube sheets are used. This is predicated on the tube sheet thickness. The downtake diameter had been reduced in some instances to 10" or even less (to do so certain changes are requires.) The length of the tubes have been increased up to 6 or 7 feet. Together these have resulted in an increase of the heating surface. Added to this, is the more efficient removal of non-condensable gases and condensate water; better utilization of vapors due to a better baffling design, automatic level and density controls; sealed downtakes, etc. The whole efficiency of this equipment has improved to achieve evaporation rates of 12 pounds per sq. ft. of H.S. per Hr., or more.

If we add to the mechanical effect of more heating surface and the thermal effect of better heat transfer, we find that evaporation has been increased tremendously for the same size body.

Let's take a look at the physical affect of vapor volume increase, due to a better vacuum and more non-condensable gases. The difference in vapor volume between 26" of mercury vacuum, and 26.5" vacuum is from 182 to 201 cubic feet per pound.

This means a 10% increase in velocity, assuming that the other values remain constant.

Besides raising the vacuum, the temperature differential between the calandria and the liquor belt is increased and consequently the evaporation rate is increased too. For example: if all the other factors remain constant

At 26" Hg vacuum $T = 50^{\circ}F$

At 26.5" Hg vacuum $T = 55^{\circ}F$

This $5^{\circ}F$ differential in the last body will mean a 3% increase of ΔT, which does not necessarily mean a 3% increase of evaporation since this is affected by the higher viscoscity due to temperature drop, but it means an increase in evaporation.

Let's calculate the velocity of the vapors leaving an evaporator of the same diameter with 63.5 sq. ft. of sectional area. One with A-3000 sq. ft. of heating surface, 146 cubic feet per pound of steam (25" Hg) and 8 pounds per sq. ft. hour evaporation.

B-5,240 sq. ft. of heating surface 12 pounds per sq. ft. hour evaporation and 214 cubic feet per pound of steam.

A = 15.3 feet per sec = 10 miles per hour

B = 58.9 feet per sec = 40 miles per hour

We can see that the speed of the vapors leaving the boiling surface of the liquid, has been increased more than three times.

In the above case we have not considered the effect of the non-condensable gases because of the lack of data that would enable us to know the quantity of non-condensables in the vapors of the last body.

Apparently, the general practice of using certain types of fertilizer lately has caused an increase in the amount of non-condensable gases in the juice. This has not had a detrimental effect on the vacuum itself due to better and larger vacuum equipment. Still, we can figure out that according to the law of mixtures of gases, an increase, let's say, of 5% in the amount of non-condensables would represent, at 26" of vacuum, an increase of 4% in the volume of the mixture. This is due to the fact that the actual pressure over the "stean part of the mixture" (or what we call vapors) is lowered from 2.0 psia to 1.8 psia. As you can see,

the increase in non-condensable gases has a noticeable effect on the velocity of the vapors.

As far as we know, the trend on the design of the catchall or entrainment separator has been in the design or modifications of the catchall itself, and to prevent the small droplets of juice from reaching it, the catchall has been raised higher, and higher above the tubes.

In our opinion, if a droplet is surrounded by a fast moving stream traveling at nearly 50 miles per hour, it is going to continue traveling in that same direction. On the contrary, if the vapor stream is slowed down it is going to be easier for these droplets to fall.

With this in mind, we designed an evaporator in which the diameter of the liquor belt is larger than that of the calandria.

The question would arise that it would be simpler to make the whole body larger, but besides increasing the cost of the equipment, especially the cost of the bottom and tube sheets, it would impair the work or efficiency of the evaporator in many ways. For instance:

First: There would be a greater volume of juice in the body, thus a longer time under the effect of the heat, which is detrimental to the juice.

Second: The tubes would have to be made shorter or spaced further. (In order to have the same heating surface) In either case that would mean lowering the efficiency of the evaporator.

Third: A larger unit would require heavier support beams and increased cost of foundation and erection.

Besides all the other reasons, in a larger diameter cell, if the catchall used is of the centrifugal type, and made to fit the entire

diameter of the c ll, the vapors going through the separator are going to be more times under the effect of the centrifugal force without noticeable increase in friction due to the velocity.

THINGS THAT IMPROVE EVAPORATION

Among the things that improved the evaporation we think that a sealed downtake and copper bearing steel tube sheets are advantageous in designing evaporators for the following reasons:

A) Sealed downtake: Although the use of sealed downtake seems rather new, we have seen drawings of a Belgian evaporator made in 1907, that had an attachment to use the downtake sealed, semi-sealed, or open. So it is nothing new to be afraid of.

We believe that the sealed downtake increases the capacity of the evaporator to a large degree. The best statement illustrating this came from an evaporator operator who made the following comment when asked how the evaporator was working: "It is alright now because you are not grinding much, but we will see when you speed up." At that moment we were grinding 12% more than the evaporators had been able to handle before the sealed downtakes had been installed.

There are few arguments against the sealed downtake. One of them is that the liquid only passes through the tubes once. We believe that this is better than not passing at all, as you can see on table #1. With the open DT. the juice sometimes flashes in a body and goes out again to the next one without passing through the tubes. We have proof of this because in every sugar factory that we have worked, we have installed a device to take samples of the juice going in and out of each body. In one triple in which the inlet manifold and outlet pipe were 18" apart, the evaporation in the body was only 16%. It was increased to 25% when the downtake was sealed.

Another complaint about sealed downtake is that you get entrainment because of surges and violent boiling.

(1) The first can be solved by the proper type of juice baffle and the right type of level control. The second; "violent boiling," should not be solved because that is precisely what we are looking for so just use an effective type of catchall.

It has been argued that it is impossible to use the level-control, if you have the downtake sealed.

In the first place I do not think that this is a fair reason because they are implicit in accepting that the sealed downtake is better than an open one.

In the second place it does not sound logical to substitute a cheap efficiency gadget (sealed D.T.) by a more expensive one (automatic level control) to accomplish the same thing.

We believe that it is not a problem of removing the level controls, but to install them properly and we have seen them working together efficiently in a quadruple with sealed downtake and with the simplest level control that exists, the direct actuated valve by a ball float. There are various combinations of arranging the level controls and in each case it should be studied which one to use.

Copper bearing steel tube sheet:

We favor the use of copper bearing steel tube sheets instead of copper ones. We believe that copper bearing steel simplifies the design of an evaporator and makes its manufacture more economical.

The reason for not using copper bearing steel is because of corrosion. We do not think that it is corrosion alone, but galvanic action, because it is localized around tubes. We believe this can be prevented economically

and completely by the use of plastic, or clad steel. Besides, there are so many advantages in the use of copper bearing steel that we think they overcome those of copper. Some of these are as follows:

1 - The tubes can be located closer together which means more heating surface in the same diameter evaporator.

2 - Calandria flanges and gaskets, which are both expensive and prone to develop leaks are avoided.

3 - The construction and placing of the downtake is greatly simplified.

4 - It is easier to use small downtake, 10" diameter.

5 - The outside connection for condensate drain is easily and reliably made, thus avoiding the inside connection which is a source of considerable trouble.

6 - If there is a necessity of steam baffles these can be placed and secured much better in a copper bearing steel tube sheet than in a copper one.

7 - If an extra non-condensable gas outlet, or any other fixture is required, it is easier to install, and without any inside arrangement you can be sure that the space under the tube sheet will be kept free of gases.

The results of open and sealed downtake can be seen in table #1 in which you can see how the work is better distributed among the three bodies which necessarily means more capacity.

Please note that even the total evaporation is bigger in the first case this is not comparable since we were slowed down in the first case and not in the second.

Following the preceding reasoning, we designed an evaporator with these specifications:

Calandria 9' - 0" diameter, 6' - 0" face to face of tube sheets.

Downtake - 14" diameter

Liquor belt - 11' - 0" diameter

Height up to the base of the catchall 12' - 6"

Catchall type: Centrifugal

Level control: Automatic inlet control

Attachment for sealing or opening the downtake

Number of tubes: 2,256

Size of tubes: 1 1/2" O.D. x 6' - 0 1/2" long

Heating surface: 5,240 square feet

There are no steam baffles on the steam side of the calandria because the velocity of the steam is lowered before entering the calandria shell. Consequently, there is no lost space in the tube sheet for steam baffles. Due to this, the tubes are very close to the steam inlet and there is no sign of the slightest wear on the outside of the tubes. Due to localized problems we could not make the tube sheets of copper bearing steel, therefore, the design of an outside condensate drain, was very difficult but was finally worked out so that there would be no inside connections.

There is a sight glass in the calandria so that the flow of the condensate can be checked. We didn't have enough height for draining the condensate when the vacuum in the calandria was above 20", but, when it was below 20" the level gauge never showed more than one inch of condensate inside the calandria. (For 1964 crop the condensate tanks were lowered and even with 25" of vacuum in the calandria of the last body there was no water in it.

There is a special hook on the connections of the level control to take care of the variations of the level indicator due to the effect of dynamic pressure.

On the same steam distributor, there is a valve (36" diameter) made integrally with this distributor and hydraulically operated. The vapor pipe to the condenser is 5' diameter.

The condenser is the multitray type, with a special vapor connection which was designed, due to the lack of space, to run a 4' pipe, and also for improving the mixing of the vapors and water.

All these things were designed in close cooperation with the technical staff of St. Mary Iron Works.

This new body took the place of the last body of a triple effect, in which the first and second body have 3,800 square feet of heating surface each.

First, let me explain how the older triple was working, so we can better explain the improvements made.

We had a standard triple effect, open downtake, with level and vacuum control. We were having heavy entrainment, and we assume they had that problem for a long time because the catchall was changed twice; the last one was rather small. It was necessary to cut it and make it larger but still there was entrainment. Especially, as I learned later that during a certain time of the grinding season, the vacuum was jumping up and down from 25 1/2" Hg to 26 1/2", at a rate of 4 times a minute. You can imagine how this sudden vacuum change produced violent flashing and consequently carry over. This jumping led some of the personnel to believe it was due to air leaks. Because of this the evaporator was checked twice and also the condenser. We did not find the slightest leak.

Because of the heavy entrainment and the bad condition of the third body and the condenser, it was decided to replace both units for a new one, and increase the capacity of the other two. This would have meant throwing away the tubes of the first 2 calandrias, which were practically new. We were against this, and finally succeded in getting our ideas through in this way.

We repaired the old third body and its condenser, and continued to use it. The downtake of this evaporator was in very bad condition, it was 30" diameter. We put in a new one made out of a piece of 18" pipe which we managed to slide through the manhold, so no major job was encountered.

Having the advantage of a valve in the vapor line from the second body to the calandria of the third, we installed the new body with its condenser and with the integral valve, which we previously explained, so we would have one triple with two last bodies.

It is a well known fact that the last body is the one that scales most. Against a sustained belief that the first body should be the largest, we have made the last body the largest. This enables us to have more capacity in the body, when it is scaling, which is precisely the time we need it most.

Our idea was to work with #1, #2 and the new one as long as possible. Then, without stopping the mill, shift to the old #3 body and keep grinding with the old set, while the new body was being cleaned. As soon as it was clean, shift back to the new one. This enables the old body to be used at a minimum, which would eliminate cleaning it during the crop.

This arrangement was rehearsed before grinding and was carried on during grinding without stopping or slowing down. The first time we had to slow down, but the other times it was done by the evaporator man with one helper (we have only one vacuum jet for both evaporators) without a single problem.

With this arrangement, we managed to grind for 21 days before stopping to clean the first two bodies. Before this, we had to stop every other Sunday for washout, and the days before washout we had to slow down to a rate of around 2,000 tons.

We could not keep the 21 days between washing schedule during the whole crop because of various reasons beyond our control, as you can see in table 2, but we did manage to save almost two washouts for the same amount of grinding days, and we were grinding around 2100 tons the day before washout.

During grinding, we noticed that sometimes light juice was found in the last body. Samples were taken of the juice flowing in and out of each body, and we found that the second body was doing very little, as you can see in table 1 part 1 before sealing down take. During one washout, we placed an attachment in the downtake of the second body so we could prevent any short circuit of the juice. The results can be seen in table 1 part two. (On one occasion, we had some problems with the new body and found that the supporting bolts of the seal for the downtake had failed due to heavy corrosion.)

As a matter of fact, after the second washout, we had to change some of the piping of the level control for that reason. After solving that problem, it was judged that the evaporator worked much better with the sealed downtake and was operated that way permanently.

On another occasion, I was called because the vacuum was varying (jumping) and there was carryover in the new body, which was checked in the lab as traces. We shifted over to the old body so we could check the new one, but we couldn't find anything wrong either in the evaporator, the condenser, or the vacuum control valve. At that moment, our attention was called by the evaporator man to the fact that the same thing was happening in the old one. The only difference was that it was more difficult to see because of the smaller sight glasses on the old body. Before shifting back to the new evaporator, we had a test made of the condenser water and it showed strong traces.

At this point, we decided to look for the source of the trouble in one of the common equipment, the vacuum control, since we believed that this was the source of the trouble, due to the fact that the water valve of the new condenser is too large and the one on the old one is too small, the idea of an improper size valve was discarded (besides the valve moves only on signal from the control). In the meantime, we decided to take out the vacuum control and operate it by hand. Even though this was very erratic due to the fact that the hand valve was in a place very difficult to use, the vacuum remained fairly constant and entrainment was eliminated.

This may not be very flattering for us, but we kept trying to find the reason for this behavior, and up to this moment we haven't found it. What we can say is that after about two weeks of trying to fix it one morning when we put the control back into operation to keep on working on it, it started working in perfect condition and we finished grinding with no apparent trouble. For this next crop we have made some changes in the vacuum control set-up and whatever the results are, we will be pleased to inform you. Up to here is our experience on this problem during the 1963 grinding.

When speaking of which body should have more heating surface, the first or the last body, we mentioned that we preferred to have it in the last body. Another reason for this is it is very easy to increase capacity of the first body by placing a pre-heater ahead of it. It is cheaper this way because every square foot of heating surface used on a preheater is equal to two square feet used on the body itself, with the advantage that this equipment can be taken out of the line while grinding and cleaned, so it will be clean when needed most. This is the way we have it, and it sure is a great relief.

You may see on table 3 how we operate the evaporator before the first run. We have called the old third body #3, and the new one #4.

On table #2 you can see how, with 18 more days of crop, we had one less stop for washout and besides that, the grinding rate, in between washout was higher than the preceding year.

During 1964 crop we were able to find the reason for the vacuum jumping. We have automatic priming devices for the condenser water pumps. These devices are connected to the pans through a common vacuum line and individual check valves in each pan. The pans have automatic vacuum breaker to hold the vacuum up to a certain limit........ Well one day in 1964 working in the vacuum control, we noticed that the vacuum remained stationary after removing one defective check valve in one of the pans. Looking in the 1962 diary that we carry, we found that the night before the vacuum problem solved itself, because of a vacuum failure in the pans, the assistant engineer removed the defective check valve in one of the pans.

* 1 - We have not taken into consideration 2 old types of evaporators, the "Kestner, or the Badger," which we consider to have the best thermic design, because they have not been very popular in the sugar industry. The main reason given was too much entrainment. In a matter of fact in the only sugar mill that we know that have this type is Sterling Sugar Mill in which I believe after some arrangement was made to work right.

TABLE 1

Part 1

BEFORE SEALING DOWNTAKE OF #2 BODY.

	First Test		Second Test	
	Brix	%E	Brix	%E
Clear Juice	15.4	X	16.0	X
No. 1 body outlet	20.2	24	22.5	28.9
No. 2 body outlet	26.4	18	29.0	15.9
Syrup	61.2	33	61.9	29.3
		75		74.1

Part 2

AFTER SEMI-SEALING DOWNTAKE OF NO. 2 BODY.

	First Test		Second Test	
	Brix	%E	Brix	%E
Clear Juice	15.4		15.2	X
No. 1	20.1	23.4	19.6	22.4
No. 2	29.9	25.1	28.5	24.3
Syrup	59.2	25.5	50.6	23.3
		74.0		70.0

TABLE 2

1962 CROP 69 DAYS

STOPS FOR	TONS GROUND SINCE LAST W.O.	GRINDING RATE BEFORE STOPPING
FIRST W.O.	21900	2000 tons/24h
SECOND W.O.	2990	2270
THIRD W.O.	28600	1950
FOURTH W.O.	23800	2000
FIFTH W.O.	20400	2100
SIXTH END OF CROP	15400	2100

1963 CROP 87 DAYS

FIRST W.O.	41600	2100
SECOND W.O., CRUSHER BROKE	29700	2380
THIRD W.O.	39200	2400
FOURTH W.O.	30500	2100 Slow down due to rain
FIFTH, END OF CROP	35300	1700 Slow down due to end of crop

TABLE 3

FIRST RUN

	TONS GROUND	
1:2:4	22900	
1:2:3	2300	cleaning #4
1:2:4	10300	#4 back in operation
1:2:4 and Preheater	6100	using the preheater
TOTAL	41600	

TWELFTH CONGRESS - I.S.S.C.T. 1965
A REPORT

Denver T. Loupe, Specialist (Agronomy)
L.S.U. Agricultural Extension Service, and
Secretary-Treasurer, ASSCT

The 12th Congress - I.S.S.C.T. convened at 9:30 A.M. on Monday, March 29, 1965 at a General Meeting in the Grand Ballroom of the San Juan Sheraton Hotel. Mr. M. Emile Hugot, Reunion, served as General Chairman. Several talks of welcome, a briefing about the Puerto Rican Sugar Industry and brief "In Memoriam" to Mr. Manuel A. del Valle, got this congress underway.

An afternoon Plenary Session included various committee reports and an address by the Honorable Harold D. Cooley, Chairman, Committee on Agriculture, House of Representatives, U. S. Congress.

The remainder of the Congress consisted of meetings of the various Sectional Groups and Tours. These Sectional Meetings included: Processing, Engineering, Breeding, Entomology, Pathology, By-Products, and Agriculture.

For the purposes of my discussion on the organization and conduct of the Congress, I would like to furnish some background information about the Society.

As set forth in the Constitution, "the objects of this Society shall be to promote the discussions of the technical problems of the sugar cane industry in both field and factory, by means of Congresses held as far as practical every three years, to foster at all times the free and frank interchange of technical information by medium of publications or other means, and to support worthy research projects designed for the benefit of all when approved by the majority of the members present at congress meetings."

The actual administration of the society is through an Executive

Committee which consists of the General Chairman, General Vice-Chairman and the General Secretary-Treasurer. They direct the policies of the Society as charged by members in general meetings. There is also an Administrative Committee consisting of the General Chairman, General Vice-Chairman, Regional Vice-Chairman and the General Secretary-Treasurer. The General Chairman is the presiding officer of this committee. The Administrative Committee is called together at the time of a general meeting for general decisions on Society business and resolutions to the congress in its final business meeting. It is the duty of this committee to review the work of standing committees and determine whether they should be continued or altered and make recommendations to the congress.

During the 12th congress, the Administrative Committee held five special meetings. As Regional Vice-Chairman for the mainland U.S.A. delegates, I attended each of these meetings and participated in the deliberations. It is during these administrative committee meetings that the business of the Society and its course actually charted. Standing Committee reports were reviewed, additional committees appointed and numerous items discussed. Among the business to come before the committee and subsequently approved at the final General Meeting, which should be of interest to our ASSCT members are the following:

1. Life Members: This membership designation has been in the constitution for years, but until this Congress, there had not been anyone so designated. However, at this congress, eight names were proposed and elected. Among these were Dr. Claude W. Edgerton of Louisiana.

2. Because of the large number of papers presented and the length of some of these, problems have been created in programing and publication. In the future, more rigid instructions defining subject matter, reference quotation, figure format and other relevant matter will be spelled out for

the guidance of authors. These instructions will be received by members through their Regional Vice-Chairmen.

3. Additional responsibilities have been placed on the Regional Vice-Chairman, and therefore members of the A.S.S.C.T. who are also members of the I.S.S.C.T. should be concerned and involve themselves in the selection of same.

4. The 13th Congress, I.S.S.C.T., 1968 will be held in Taiwan with a post-Congress trip to the Philippines. Notice of invitation for 14th Congress to be held in Louisiana was announced.

Much of the remaining activities included social functions such as visits to City Hall and a rece p tion by the Mayoress of San Juan, a visit to LaFortaleza and cocktails with his Excellency, the Governor, and other interesting tours.

There are presently 1428 paid-up members which make up the 29 Regional Divisions of the I.S.S.C.T. There were 170 delegates from the Mainland U.S.A. Of these, around 35 were from Louisiana.

The 12th Congress, I.S.S.C.T. 1965, adjourned at the final Plerary Session on Friday Morning, April 9.

A REPORT ON SUGAR CANE IN PUERTO RICO

Lloyd L. Lauden, Agronomist
American Sugar Cane League
414 Whitney Building, New Orleans, Louisiana

Puerto Rico is the smallest island of the Greater Antilles group containing approximately 3500 square miles. It is rectangular in shape and is approximately 35 miles wide and 100 miles long. It is about 1000 miles southeast of Miami, Florida, and only three and a quarter hours from New Orleans by jet plane. The present estimate of the population is 2,500,000.

Although the culture is basically Spanish, changes in customs are rapidly taking place and the English language is widely spoken. The Island became a possession of the U.S. following the Spanish American War in 1898, but Puerto now has a Commonwealth status with a voice but no vote in the U.S. Congress. There is talk of Statehood on the Island.

Puerto Rico is one of the four principal domestic sugar producing areas and in 1964 produced 989,438 tons sugar, raw value, from 303,142 acres harvested. That year the Island averaged 32.3 tons of cane per acre and 201.9 lbs. of sugar per ton of cane. The molasses produced per ton of cane was 6.568 gallons. Cane is grown on the coastal plains encircling the island and in the valleys of the central mountain range that extends the nearly 100 miles of the island's length.

There are 11,600 cane growers on the Island. Of this number, 8,500 produce cane on 10 acres or less and in total produce only about 8 percent of the cane harvested. Some 200 of the larger growers produce about 60 percent of the total crop. There are 24 factories, nineteen along the coast of the island and 5 in the valleys of the interior. Very few grow much of the cane they process. The factories are not new. The last mill constructed started production in 1939. There are four sugar refineries,

three are independent, and one is part of the business of a raw sugar factory. All four refineries produce white sugar for local consumption and three of these produce and ship some white sugar to mainland United States.

The main reason for a relatively small amount of factory affiliated or administration grown cane on the Island is the official land ownership policy followed since the island was ceded to the United States. In effect, the law prohibits ownership tracts larger than 500 acres. For a period of time the law was not enforced but during the middle 30's, after court proceedings were instituted against several sugar companies, a number of other companies under threat of expropriation sold their land to the Government or to individuals. This condition brought about de-emphasis of the agricultural part of the sugar industry. Monies available were spent in factories and not in the fields where sugar is really produced. For a while production remained steady but since the mid 50's production was declined.

Efforts are now being made to halt this decline in production. Arrangements are being made for the resumption of large-scale operations through rental arrangement and management contracts.

The variety development program is now undergoing a change. Although the program is under the guidance of the University of Puerto Rico, the U.S. Department of Agriculture, the Government of Puerto Rico and The Association of Sugar Producers of Puerto Rico cooperate with the University in the variety program. In addition to the Puerto Rico produced seedlings, the cooperating agencies are introducing through quarantine, varieties from elsewhere hoping to bridge the gap until their own breeding program can produce outstanding varieties.

Although some progress has been made over the past ten years in field mechanization, there is a need for mechanical research and development, particularly in the harvesting operation. In 1953 it took 13.3 hours to produce a ton of cane, 5.4 hours for harvest and 7.9 for non-harvest. In 1963 it took 8.6 hours to produce a ton of cane, 4.6 hours for harvest, and 4.0 hours for non-harvest work.

The trend is toward mechanization. In 1955 only 8.3 percent of the cane was mechanically loaded and in 1964 53.4 percent of the cane was mechanically loaded. Only a small amount of cane had been mechanically cut on a commercial scale in Puerto Rico until this year. There is now a great amount of interest in mechanic a l harvesters, and in fact, there are at least three experimental harvesters being presently studied and at least three types of commerical harvesters being tried. Some of the cane is fairly erect and can be harvested quite satisfactorily with Louisiana type harvester. For the heavier cane, which is badly crooked and badly lodged, other type harvesters will have to be developed before this type cane can be satisfactorily harvested mechanically.

Cane is planted by hand and one running stalk and a short lap is the general practice. Cane is "whacked" or cut into pieces after it is placed in the planting furrow. Cane is generally planted in what Louisiana growers call the water furrow. However, there is some cane now being planted on a modified Louisiana system to suit mechanical harvesting equipment.

There is a considerable amount of variation between areas in the amount of rainfall received annually. Some cane areas receive as little as 20 inches and other areas receive as much as 100 inches per year. Furrow irrigation of cane is a general practice on the south coast of the Island where the rainfall varies from 20 to 40 inches per year.

Spring planted cane grows about 12 months before it is harvested, late summer and fall planted cane grows about 16 to 18 months before it is harvested and stubble cane is usually about 12 months old when it is harvested. Grinding usually starts in January and ends in late June to early July.

Large cane growers are applying insecticides and herbicides by aircraft. Both the fixed wing and the helicopter are used for these operations. A good job of weed control has been done with chemicals. Fields are generally clean throughout the Island. There was no Johnson grass observed on the Island.

In spite of the fact that other crops and industry, along with tourism are becoming important to the economy of the Island, the sugar industry is determined to continue to play a major role in the financial well being of Puerto Rico.

The people of the Island are kind, helpful and very hospitable.

NOTE: Statistics were taken from reports of Mr. Dudley Smith, Vice President, Washington Office Association of Sugar Producers of Puerto Rico and from reports of Juan B. Garcia-Mendez, Executive Vice-President, Sugar Producers Association of Puerto Rico.

Some Research Papers Related to Louisiana Problems Presented at the 12th Congress of the International Society of Sugarcane Technologists

by R. D. Breaux [1]

Introduction

The field group of the International Society of Sugarcane Technologists is divided into four sections--Agriculture, Breeding, Entomology and Pathology. Over 200 scientists from practically every sugar-producing country of the world presented approximately 185 papers to the different sections. Not even the briefest summation would be possible for each of these papers. The few selected for review at this meeting were related to problems faced by Louisiana sugar growers.

Agriculture Section

Louisiana farmers are prone to think that they are the only members of the world sugar industry burdened with sub-freezing temperatures. Undoubtedly, the problem is more constantly with us. However, freezing temperatures have been previously reported from Queensland, Australia, and Tucuman, Argentina. Kenneth A. Sund (7) reported on the cold-injured 1963-64 crop in Iran because it was of a magnitude comparable to damage in Louisiana. The harvest season began in Iran on December 1, 1963, but by February 10, all cane brought to the mill had been cut in half and operations ceased 12 days later. About one-third of the expected crop was lost.

- -

1/ Crops Research Division, Agricultural Research Service, U. S. Dept. of Agriculture, U. S. Sugarcane Field Station, Houma, Louisiana

Minimum temperatures dipped to 26^{o} F. on January 19, after which it was successively 18.5, 20.3, 22.1, 23.0, 26.6, 27.5, 29.3, and 29.3^{o} F. to the end of the month. There were 25 hours of consecutive freezing on January 19.

Damage was apparently of about the same order as to cane in Louisiana. Terminal buds were killed when the minimum fell to 1^{o} below freezing. Leaves lost their green color in a week to 10 days after frost. Lateral buds were killed or damaged after 25 hours of sub-freezing temperature. Examining foliage, pulling out dead spindles, or "smelling" were unreliable test for assessing injury to the cane. Slicing the stalks to pass through the eye in its length was the best way to select sound seed cane.

Three commercial varieties in Iran, N. Co. 310, C. P. 44-101, and C. P. 35-105, behaved as they would in Louisiana after cold injury. C. P. 36-105 deteriorated most rapidly, and N. Co. 310 least rapidly.

Milling operations ceased when a titrable acidity of about 5 and pH of about 4.3 were reached in both locations. However, this point was reached much sooner (20 days) in Louisiana than in Iran (56 days). The better keeping qualities of the Iran cane were probably due to higher minimum temperatures, continued cold and dry weather (less than 1 inch of rainfall) for the 8 weeks following the freeze.

Experiments on varying row widths in Natal, South Africa, were reported on by Thompson and du Toit (8). In previous tests row widths narrower than commercial practice (4.5 feet) showed a trend toward higher yields. However, results of these experiments were not always significant, nor were the differences of such a magnitude as to warrant a firm recommendation for narrower rows. These latest row width experi-

ments were conducted at two fertilizer levels. F1- or adequate fertilizer and F2- high nitrogen levels to measure the fertilizer X row-Spacing interaction. Surprisingly, yield trends in relation to row spacing followed the anticipated direction at the F-1 fertilizer levels but an almost complete reversal took place at the (F2) fertilizer level, particularly in terms of sugar per acre. The high fertilizer level generated high stalk populations, but at close spacing subsequent mortality led to depressed yields of cane and sugar per acre. The mortality of shoots and survival of thin light shoots was due mainly to within-row shading and moisture in the closely planted crop.

Another row-spacing experiment was designed to study the possibility that a sugarcane variety with a low population of stalks at 4.5-foot spacing might be induced to yield better in relation to other varieties at closer spacings. The low-yielding variety, however, remained low at all row spacings.

Pathology

Australia's experiences, as reported by Egan (4), with deterioration of burnt cane cut with chopper-type harvesters would be of interest to Louisiana growers and processors. During the 1962 and subsequent seasons, serious losses in sugar content were noticed in chopped cane stored at the mill over weekends. Mills do not operate on weekends in Queensland. Tests of sour loads during the 1962 and 1963 seasons showed average sugar losses of 14% of total sugar in freshly cut cane. The chopped-up cane exuded a strong sour odor after 2 days' storage, and the juice smelled sour and had a much lower pH. The problem was apparently one of typical microbiological deterioration. Isolates from sour cane yielded <u>Leuconostoc</u>, usually in pure culture. Inoculations

of cut-up cane reproduced the disease.

Leuconostoc was isolated from green and burnt standing cane, from harvested cane on the ground, from the soil, and from juice-soaked mud in the harvester. Infection probably occurs at the time of harvest, when the organism apparently establishes itself throughout the cut piece within a few hours.

Regarding solutions to the problem Egan stated: "The ideal solution would be to eliminate all weekend storage of chopped-up cane, but this is virtually impossible to achieve under present conditions in Queensland. In view of the rapidity of infection and colonization of cane pieces, other control measures offer little hope at this stage, although the use of sharp, well-adjusted harvester blades to cut freshly burnt cane should ameliorate the situation".

Pathologists and breeders met in joint session to discuss methods of screening sugarcane progenies for resistance to different diseases. A paper by Dean and Coleman (3), regarding the screening of seedling populations for resistance to mosaic was timely, considering the intensive search for higher degrees of resistance in progress in Louisiana. Mechanical inoculation of young container-grown seedlings is a common means of selecting for mosaic resistance in breeding programs. This method of screening for resistance could fail completely were there no correlation between reaction to mosaic in the screening program and in the field. If the correlation were less than perfect, some plants with adequate field resistance might either be discarded, or some with inadequate field resistance selected, or both.

The authors devised a technique for splitting young seedlings to obtain pairs of genetically identical sugarcane "seedlings". Three

types of experiments were conducted. In all three the first member of each pair was inoculated mechanically in the young seedling stage. Other members of each pair were exposed to: a) mosaic by aphid spread in the field, b) inoculation of cuttings of mature plants, and c) aphid inoculations in cages. Sixty-three to 74% of the pairs of plants fell in agreement classes when exposed to mosaic by mechanical seedling inoculation and by the other three methods used. Plant pairs in disagreement were almost entirely those that became infected in the greenhouse by artificial inoculation but remained healthy when exposed to caged or field aphid population.

The results indicated that effective mechanical inoculation of young sugarcane seedlings infects virtually all that are susceptible to either aphid or mechanical inoculation at some later stage. The results may also indicate that a substantial number of seedlings with adequate field resistance are discarded as susceptible in the screening process. This should not be a serious problem in Louisiana; however, where the breeding program is characterized by an abundance of seed in relation to testing capacity.

Breeding

New approaches in breeding better cane varieties centered around proposals for increased use of a wider range of material of the basic *Saccharum* species. Arceneaux (1) listed pedigrees of over 100 important commercial varieties of the world. This showed that these canes could all be traced to fewer than 18 clone *S.* officinarum, 1 clone of *S. sinense*, and 3 clones of S. *spontaneum*. This raises a question. Are we limiting ourselves too severely to certain forms, or is the repeated appearance of certain forms in varietal pedigrees a reflection of the genetic superiority

of such material? Arceneaux reasoned that use of certain parents was dictated by circumstance rather than choice. Many varieties were used simply because they were there, and might owe their high frequency in commercial pedigrees to their wide distribution.

Arceneaux suggested the likelihood that the forms of _S. officinarum_ which have been used in the past were among the best available, but that it was highly improbable that Kassoer represented the most favorable F_1 combination possible between _S. officinarum_ and _S. spontaneum_. Therefore, it should be possible to develop, artificially, some better starting point of the nobilization process. He encouraged intensive attacks on specific facets of the problem, such as utilization of _S. sinense_ and _S. spontaneum_ from high altitudes for cold resistance. Screening the _spontaneums_ for higher degrees of mosaic resistance, and use of the most resistant forms, are possible long range solutions to Louisiana's mosaic problems.

Alternate approaches to the use of wild relatives of sugarcane were also outlined in papers by Daniels from Fiji (2), Heinz (5) from Hawaii, and Price (6) U. S. Department of Agriculture, Beltsville, Maryland.

Papers Reviewed

(To be published in Proceedings of the Twelfth Congress)

1. Arceneaux, B. Cultivated sugarcanes of the world and their botanical derivation. Internatl. Res. Ser. Louisiana.

2. Daniels, J. Refining sugarcane breeding methods to increase yields. South Pacific Sugar Mills Ltd. Lauthoka, Fiji.

3. Dean, J. L., and Coleman, O. H. Screening sugarcane seedlings for mosaic resistance by mechanical inoculation. U.S.D.A. Meridian, Miss.

4. Egan, B. T. A sour storage rot of mechanically harvested chopped-up sugarcane. Bureau of Sugar Expt. Sta., Brisbane, Queensland, Australia.

5. Heinz, D. J. Wild "Saccharum species for breeding in Hawaii. H.S.P.A. Experiment Station. Honolulu, Hawaii.

6. Price, S. Interspecific hybridization in sugarcane breeding. U.S.D.A. Beltsville, Maryland.

7. Sund, K. A. The effects of freezing temperatures on the 1963-64 sugarcane crop in Haft Hapeh, Iran. Hawaiian Agronomics Company International.

8. Thompson, G. D., and du Toit, J. L. The effects of row spacing on sugarcane crops in Natal. Mount Edgecombe, Natal.

THE USE OF CHEMICAL HERBICIDES IN THE CULTURE OF SUGARCANE FOR SUGAR PRODUCTION IN LOUISIANA

Ernest R. Stamper
Louisiana Agricultural Experiment Station
Louisiana State University
Baton Rouge, Louisiana

Browne (1) in a 1938 presentation stated that there probably is no large agricultural industry of the continental United States that is more subject to the uncertainties of fortune than that of sugarcane. Since the first establishment of the sugarcane industry along the northern coast of the Mexican Gulf it has had to run a constant gauntlet of adversities; at one time from frost, floods or tornadoes; at another time from insects or cane diseases; and still again from unfavorable trade or economic conditions. The story is not one of defeat. There have been some bright colors of victories over disaster.

Sugarcane culture in Louisiana goes back to 1751 when the Jesuits in Santo Domingo obtained permission to send sugarcane for seed to Louisiana. They also sent along several Negroes who understood the cultivation of sugarcane. The only implements they used in the first cultivation were hoes to dig holes and place the short pieces of cane. This same cultural practice is still done in some parts of Santo Domingo.

Taggart (26) wrote in his thesis in 1933 that in 1845 sugarcane was cultivated and made into sugar in 19 parishes in South Louisiana. This is about the same number that we have in production today.

Moore (13) in 1853 said that there were no millionaires and few Capitalists among sugar planters, the latter generally understand their own interest too well to embark in so uncertain and precarious a business.

A treatise on sugarcane culture was written by Wilkinson (28) in 1847 in which he pointed out details of cultivation of both plant cane

and stubble. There was very little difference in cultural practices in 1847 than when the tractor operation started and replaced the mule.

Maier (11) in 1952, said that the cultivation of sugarcane in Louisiana was performed almost entirely by hand labor prior to the Civil War. The preparation of the land consisted of plowing with a crude plow, drawn by one or two mules, and harrowing with a drag harrow made of brush or poles. All other cultivation was done with hand hoes and shovels.

Maier wrote on the purpose of high rows in the Louisiana sugarcane production. He stated that these rows were spaced six feet apart with middles nine to fourteen inches deep which permits cultural practices that assist in furnishing optimum condition for plant production. These conditions are light, heat, food air and water. After the crop is laid-by the only control a grower has over the maturity of the sugarcane is to keep the quarter-drains plugged for good drainage.

Wilkinson (28) in 1847 gave some figures on equipment and labor to cultivate sugarcane that was in eight foot rows. The eight foot rows were used at that time so the cane would ripen and produce good sucrose.

He described the operation of off-barring and then shaving and cleaning the row as the first operation, leaving as little dirt around the young shoots as possible so that maximum tillering could occur. He said, "And now begins the ploughing between the rows of canes, plants and stubbles, to put down the grass, to loosen the soil and to forward vegetation; for this purpose and for a field of six hundred acres of cane and two hundred acres of corn, thirteen two horse ploughs are amply sufficient, provided the teams can be changed twice a day; three hands follow each plow with their hoes to clear the grass where the plough cannot do it, and to clean the cross ditches; this working is continued until the canes are sufficiently forward to be earthed, when the fine soil between the rows is

gradually brought from their centre to the foot of the plant, thereby turning the row into as many ridges, and the space between them into so many drains sloping about one foot from the top of the ridges to the bottom, and emptying themselves in the cross drains, which in their turn run into the main drains made of sufficient capacity to carry rapidly any quantity of water that may fall during the rainy season. As soon as this work is completed which should not be later than the 15th of June, a sub-soil is run three times between each row and to the depth of one-foot; this is done very rapidly where the instrument is sharp and well shaped, and drawn by two strong mules, and adds considerably to the porosity and depth of the soil.

The canes thus brought to this stage require no more cultivation; they soon form a beautiful arch, smother the grass below, and shoot gradually their saccharine matter above from cell to cell of a tubular form, until the beginning of October, when commences the cutting, the matrassing, the grinding, and the boiling of the cane into sugar. That this mode of cultivation compared to the routine of three-fourths of our planters..."

Stubbs (23) experimented with row spacing in 1891. In his tests he compared 3, 4, 5, 6, 7 and 8 foot row spacing. He found the 5 foot rows to be very good for growing sugarcane.

Stubbs (24) wrote a treatise on sugarcane in 1900. Some of his work is still in existence today and some of the statements he made are still argued about. Stubbs wrote that the subject of shaving stubble cane was unsettled and was not universally adopted. He stated that some seasons it is profitable and proper to shave stubble cane in Louisiana. Stubbs in 1900 was the first to mention fertilizing sugarcane in Louisiana. He

describes the planting operation and drainage in the fall stating that the drains are opened 6 inches below the middles of the rows. At the proper time in the spring the cane is off-barred with two horse plows, scraped with hoes, and when large enough, is fertilized by scattering the mixture across the open furrow and narrow ridge of cane. The dirt is returned as soon as the fertilizer is applied, the middles broken out deep and clean, and the turn plows sent to the barn to remain until the next season.

He continued in describing the other operations in saying that the disc cultivator, with three small disc on each side is used for throwing dirt to the cane at the first working and the middle or diamond cultivator is used for breaking out the middles. In the second and third cultivation, two middle discs replace the three used in the first cultivation and are set at such an angle as to throw the desired amount of dirt to the cane, and is followed each time by the middle cultivator, thus completing the work with the two implements.

In 1902 Stubbs (25) wrote La. Agri. Bulletin No. 5 in which he summarized the cultivation of cane for the northern Louisiana sugarcane cultivation. He stated, "The cultivation found best for corn will generally suit sugarcane and sorghum." He suggested thorough and deep penetration of soil, cultivation rapid and shallow as the soil will permit, and lay-by when growth shades the ground.

There is very little information on sugarcane cultivation that differs from the writing by Stubbs in the early 1900 period until the publications about 1922-25.

Edgerton, Taggart and Tims (2) in 1924 mentioned that the lack of cultivation, the planting of poor seed, lack of drainage and diseases

all made up a complex that dropped the yield of cane to 7.2 tons per acre in 1924.

Table 1 shows a 13 year comparison of yield data for the entire state. The first part shows the variation in yield from 1911 to 1924. The second part shows the yield from 1951 to 1964.

According to these data the average sucrose for the period 1911 to 1924, under our present schedule of determinations for commercially recoverable sugar, was about 10.57 average. The sucrose for the period 1951 to 1964 was 12.17 average.

During the period from 1911 to 1924 there were 5 years when the yield was below the average for the 13 years, these years were 1912, 1915, 1919, 1920 and 1923.

During the period from 1951 to 1964 there were 8 years when the yield was below the average for the 13 years, these years were 1951, 1952, 1953, 1957, 1958, 1959, 1960 and 1962.

Table 1. Cane yield in Louisiana from 1911 to 1924 and 1951 to 1964.

Year/1	Tons of Cane Per Acre	Pounds of Sugar Per Ton	Pounds of Sugar Per Acre
		1911 to 1924	
1911	19.0	120	2280
1912	11.0	142	1562
1913	17.0	139	2363
1914	15.0	152	2280
1915	11.0	135	1485
1916	18.0	149	2682
1917	15.6	128	1997
1918	18.0	135	2430
1919	10.5	129	1355
1920	13.6	136.1	1851
1921	18.5	155.2	2871
1922	15.6	156.2	2437
1923	11.1	135.8	1507
Ave. for 13 yrs.	14.9	139.4	2085

1951 to 1964

1951/2	17.30	141.2	2443
1952	20.65	161.7	3340
1953	20.55	174.9	3595
1954	22.75	167.7	3816
1955	24.36	158.6	3864
1956	23.61	176.7	4171
1957	22.01	163.9	3607
1958	22.20	174.0	3863
1959	20.30	169.3	3438
1960	21.86	165.9	3627
1961	25.66	180.2	4625
1962	20.96	183.5	3846
1963	28.97	185.1	5316
Ave. for 13 yrs.	22.40	169.4	3812
Period--			
1911 - 1924	14.90	139.4	2085
Difference	7.50	30.0	1727

/1 Taken from La. Bull. No. 191.
/2 Taken from statistical issues of the Sugar Bulletin.

These two comparisons show a complete reverse of trends during the two comparisons. The greatest difference in the 1911 to 1924 yield was the 1919 low yield of 10.5 tons per acre and the highest yield was in 1911 with 19.0 tons per acre, a spread of 8.5 tons per acre. In the 1951 to 1964 the variation was from the low yield in 1951 with 17.30 tons to the high yield in 1963 with 28.97 tons per acre, a spread of 11.67 tons per acre.

These two periods were selected for comparison since the first period represented the peak of the Nobel canes until their decline. The second period represented the impact of the Canal Point varieties and the shift from hand labor and mules for cultivation until the period of tractor mechanization.

The fallow plow program for the control of Johnson grass rhizomes started just prior to 1940. The fallow plow program was considered to

be part of the routine cultivation program on Smithfield Plantation as listed in the 1942 report of Gilmore's Manuel.

Some interesting information about cost was given by Reuss (17) in 1930 on mules and tractors. He showed the following cost figures:

Operation of inter-row tractors - \$7.90/10 hr. day

Operation of straddle row tractors - \$11.27/10 hr. day

Mule maintenance - \$161.00/head on family size farm

\$210.00/head on 300 a. or more

He found that tractors on a sugarcane farm lowered the maintenance cost of mules by \$16.00 per head. Field cane loaders in 1930 cost 13.3 cents per ton to load the cane.

In 1940 McPherson and Efferson (12) showed the average labor cost per ton of cane on family farms to be \$12.61 per ton of cane sold.

Lindsey (9) in 1950 stated that due to mechanization the labor and power requirements per acre of sugarcane are decreasing.

Lindsey showed the following figures in 1950 on cost on three farm types, non-mechanized, partial mechanized and mechanized.

Power Requirements/1	Non-mechanized	Mechanized	Mechanized
Mule hours/acre	54	7	7
Cost/acre	\$10.80	\$ 3.22	\$ 5.18
Tractor hours/acre	1.2	19	19
Cost/acre	\$ 4.67	\$17.67	\$23.94
Total power/acre	\$15.47	\$20.89	\$29.12
Labor Cost/acre			
Man hours/acre	135.4	116.5	58.3
Labor cost/acre(.35/hr.)	\$47.00	\$41.00	\$20.00
Total Cost/acre	\$62.47	\$61.89	\$49.12

/1 Mules	.20	.46	.74
Tractor	3.89	.93	1.26

The cost of mule work was increased two fold when a tractor was added to the farm because the mule was used only part time, yet maintenance was continuous.

Lea (8) showed in this thesis in 1952 that the family-type farm represents the small, marginal producer who was operating at a loss as was being eliminated from field production. The intermediate-sized farm represented the optimum or most efficient producer. The large farms represent the large producer who is operating beyond the point of diminishing returns but is still efficient enough to make a profit.

Ponder (15) in 1957 stated that the labor requirements on sugarcane farms vary inversely with the size of the enterprise. Plant cane requires more man hours than does stubble. The average man hours required for both plant and stubble cane was 50 hours per acre. Fallow land requires 7 man hours per acre for man and the same for the tractor.

In personal and verbal conversation with Joe Campbell the following information was obtained for cost of cultivation in sugarcane for 1962-63 period.

Sugarcane cultivation not including planting		Per Acre
10 man hours per acre @ $1.25		$12.50
6 tractor hours per acre @ $1.50		9.00
	Total to cultivate	$21.50

Fallow plowing cost included		Per Acre
8 man hours @ $1.25		$10.00
8 tractor hours @ $1.50	Total	$12.00
		$22.00

The labor and power equipment cost figures are shown in 1950 because this was the point where mechanization and the use of chemical herbicides for weed and grass control started their major impact on sugarcane cultivation in Louisiana.

Loupe (10) in 1956 reported that a survey showed that 45.8 per cent of the total sugarcane acreage was receiving the recommended chemical treatment for weed and grass control as set forth by the L.S.U. Agricultural Experiment Station. He also showed that 73.8 per cent of the acreage was using some chemical herbicide, even though they may not have used the recommended practice for total weed and grass control.

Usually there are two or not more than three main reasons for cultivation of sugarcane, regardless of what country we speak of. In Louisiana the two main reasons for cultivation have been weed and grass control and drainage.

King, Mungomery and Hughes (7) in 1953 stated that in Australia after the cane is planted the subsequent cultivation practices are designed with two ends in view. The first is to control weeds and grass growth and the second to maintain the planting drill in open condition until such time as stooling of the cane is well advanced. They also stated that there is a direct correlation between the depth of cane and the degree of stooling.

Herbert (4) in 1963 pointed out that it is not necessary to leave the row on the off-bar furrow as was formerly done but that the row can be rebuilt immediately. In the same publication in 1963 he stated that growers are not in agreement in regard to the time of dirting young cane in the spring. The Nobel varieties formerly grown in Louisiana were slow in tillering and could not be dirted until a good stand was established. The varieties grown now tiller much earlier and can be dirted sooner without important effect on yields. There were no significant differences in early dirting of C.P. 36-105, C.P. 48-103, and C.P. 44-101 when compared with dirting in April.

Hebert and Mathern (6) in 1956 gave a complete report on the modified method of off-barring and rebuilding the row in one operation. Their work showed that the two reasons for off-barring in the old manner have been eliminated in recent years. Labor shortage and the use of herbicides have virtually forced discontinuance of hand hoeing for weed control, while anhydrous or aqua ammonia have replaced solid fertilizer. The fertilizers are applied with tools that do not require off-barring. These workers conclude that there is every reason to build up the row immediately after off-barring because of the better drainage that this method affords.

Herbert (5) and Loupe have demonstrated planting methods of sugarcane on a number of Field Day tours throughout the Louisiana sugarcane belt. Most growers have not grasped or made use of these demonstrations. There are two sets of terms used that are very important but are not generally use; these are:

1. Depth of Seed Placement

(a) For summer or early fall planting the seed cane should be placed approximately 3 inches above the furrow.

(b) The late October or November planting the seed should be placed 6 inches above the furrow. Shallow covering is recommended, especially in August and September.

2. Depth of Covering

(a) The cane should be covered with only 2 to 3 inches of soil in the summer or early fall. This cane should be dirted when it begins to grow to protect it from cold.

(b) Cane planted in the late fall should be covered with 4 to 6 inches of soil.

Rodrigue (16) in 1963 was the first sugarcane grower to report on using the modified method of not leaving sugarcane on the off-bar early

in the spring. He pointed this out prior to 1940. Gold Mine Plantation grew approximately 500 acres of sugarcane and 200 acres of corn and peas or soybeans with a production of 13 tons of sugarcane and 15 bushels of corn per acre.

In 1948 they started growing cane without leaving it on the off-bar. Rodrigue said, "Besides the number of trips around the field this method of cultivation eliminated, I find it is a big help in grass control because the same soil that was on top in the drill during the plant cane year is still more or less on top during the stubble crops. We clean it during the plant cane year so there are less seeds to germinate during the stubble crops." Rodrigue stated that his rate of fertilizer was 175 units of nitrogen in second year stubble and 150 units in the first year stubble. This gives the cane lots of growth and therefore when we harvest we have to top low to get standard sucrose. He states that they leave approximately 15 per cent of the harvested crop in the field by topping low and still averaged 37 tons to the acre in 1962. Rodrigue said that he has made yields of 45 tons with second stubble and believes that in the near future he will average 50 tons of cane per acre.

For the last several decades major changes have occurred in the culture practices of sugarcane in Louisiana. Most of the changes that have had a real impact on the sugarcane industry has been at the beginning of the decade.

<u>1880 - 1900</u>

Improvement in stationary or non-moving equipment was introduced. This included the left hand plow and the Mallon Hoe which was the forerunner of the Longman and Petri hoe.

<u>1900 - 1920</u>

There was not too much change in cultivation during this period

with the exception that larger mules were used and hitched in different positions to give increased power.

1920 - 1930

In 1917, Mr. B. C. Thomson developed the cane plow for tractor equipment. It was during this period that the industry reached the low yield of sugarcane and almost failed to survive. With the introduction of the P.O.J. canes the industry regained and began to make a return to its place in agriculture.

1930 - 1940

In 1928 Mr. Thomson introduced the high clearance, high speed tractor to fit a six foot row. On this tractor he put a lifting device to lift the implements at the headland. In 1931 he outfitted the rubber tire cane carts to haul cane from the field. The Canal Point varieties of sugarcane began to appear, and Co. 281 and 290 were grown as commercial varieties.

1940 - 1950

New varieties continued to make an impact on improving the status of the industry. Mechanization continued to improve and it was during this period that weeds and grasses became a real detriment to the yields of sugarcane. Tractor cultivation, supplemented with mule drawn equipment could not control such pests as Alligator weed and Johnson grass. The missing link in sugarcane mechanization in Louisiana was weed and grass control.

The first scientific paper on 2,4-D appeared in 1944. Some sugarcane growers in Louisiana were using 2,4-D before the first paper appeared. Mr. Irvin Legendre Sr.[/1] and co-workers, at Leighton Sugar Factory, formulated and used 2,4-D in the early 40's for Alligator weed control.

During the period of 1940 to 1960 sugarcane in Louisiana received the most frequent and continuous cultivations of any period of time.

The rubber tire tractors were fast compared with mule drawn equipment. Many sugarcane growers would complete a cultivation operation and return immediately to the field to chop the sides of the rows. Flame cultivations were introduced during the early 1940's with very little success.

1950 - 1960

Fallow plowing of lands to be planted to sugarcane was shown to be a very importan art of the cultural practices. Johnson grass seddlings, as well as annual weeds and grasses were real problems in over ½ the acreage of sugarcane.

/1 Verbal conversation apparently never published.

Many workers at the Louisiana State University as well as U. S. Dept. of Agriculture workers spent time working with Johnson grass seed and rhizomes.

Much time was spent with formulation of 2,4-D and their effect on weeds and grass as well as sugarcane. T.C.A. (trichloroacetate) was tested and found to be effective in pre-emergence control of grasses and Johnson grass seedlings. Several hundred chemicals and rates of chemicals were tested and evaluated for use in weed and grass control in sugarcane. Chemicals such as Karmex, Simazine, Atrazine, Pentachlorophenol, oils, carbamates, and others all failed to give the necessary control needed in the sugarcane. Dalapon (Dow Pon) showed promise but was toxic at high rates to all sugarcane and even at low rates to some varieties.

1960 - ??

Fenac (sodium salt of 2,3,6-trichlorophenylacetic acid) was first

used on Alma Plantation in 1959 in small plot studies. It's use in the sugarcane area as a pre-emergence herbicide has opened a new field for the use of chemicals for weed and grass control. Chemicals that were used before fenac had relatively short residual action and were no longer effective herbicides if the soil was plowed or disturbed.

The residual action of fenac is somewhat over 100 days from its application. Fenac, as well as some of the other new chemicals, must have at least one inch of rainfall following application to become active in controlling weeds and grasses. Several other chemicals that are now in field tests show similar activity, including DuPont's uracils.

Chemical Herbicides and Cultivation

The cost of the TCA plus 2,4-D program recommended from 1952 until 1962 was relatively cheap. The total cost per acre in plant and stubble cane was approximately $5.00 to $6.00 per acre. Cultivation, such as shaving and off-barring was suggested as part of the weed and grass control program. The present price of fenac is $5.00 per pound and the suggested use of 5 to 6 quarts cost the growers about $10.00 to $12.00 for fenac per acre. With the use of silvex the cost in plant cane is between $12.00 and $15.00 per acre for plant cane.

For the most part with the suggested method of not leaving the cane on the off-bar, not shaving (except under certain conditions) several field cultivations can be eliminated under the present fenac program.

The elimination of three cultivations in the plant cane plus shaving would bring the cost too much below the TCA plus silvex program.

Steven's (22) in August 1964 gave a report on a 155 acre track of sugarcane on Cinclare properties. In 1962 the cane was planted and was worked in 1963 one time with double tractors, off-barring and pulling

the row back. No other cultivation was done. Weed and grass control was done with the airplane. The 1963 plant cane yield was over 30 tons per acre.

In 1964, the operation in first stubble was essentially the same except on tractor off-barred and shallow wrapped the furrows. This operation cost approximately $2.00 per acre. The stubble cane was fertilized with urea at the rate of 30 units of nitrogen per acre. Weed and grass control was done with the airplane. The cost of $11.28 per acre included fertilizer, herbicides and the flying application. A total cost of $13.28 per acre was charged against the crop up until harvest. Mr. Stevens estimated the crop in August at 32 to 35 tons per acre.

The actual yield was 28.5 tons per acre in spite of Hurricane Hilda. The chemicals used were TCA and silvex for weed and grass control applied by airplane.

Approximately one-half of this area was destroyed in 1965 and the other one-half will be handled in essentially the same manner as it was in 1964.

Several other areas were carried in 1964, with little or no cultivation. Weeds and grasses were controlled by chemicals applied by the airplane. Hurricane Hilda did not allow us to complete the information on yield. Cost of operations were very low in these areas.

Several large experiments are now under way and complete data and yield information will be available in the fall of 1965. All of these experimental test plots are on the Mississippi River and Bayou LaFourche area. The chemicals used in these test are: T.C.A., Silvex, 2,4-D and Fenac and combinations of these materials, no other chemicals are included

in the test areas. The herbicides were all applied with an airplane.

Myths in Sugarcane Cultivation

1. Are we cultivating sugarcane in Louisiana with large tractors because of tradition? Webster defines the word tradition--The oral transmission of information, beliefs, customs, etc. from ancestors to posterity without written memorials.
2. Who dictates policies in cultivating sugarcane in Louisiana in 1965--authoritative direction or overseer tradition?
3. Are owners and managers approaching sugarcane cultivation in a <u>subjective manner</u>, i.e. pertaining to the subject as the real or essential being of that which supports qualities. Or in the <u>objective manner</u> which is to deny the reality of things?
4. Possibly the key to all myths in sugarcane cultivation has been with us for many years. In all reviews of the literature the shaving and off-barring early in the spring was done to narrow the area to be hoed and allow the soil around the cane to dry and warm-up. That this operation does exactly this will not be denied by anyone.

   However, most growers forget that if cultivation, chopping and disturbing the soil, will dry it out in early March, the same chopping, disking and plowing will do exactly the same thing in dry days of June.

References

1. Browne, C. A. 1939. The Development of the Sugarcane Industry in Louisiana and the Southern United States. Proc. ISSCT Sixth Congress.

2. Edgerton, C. W., W. G. Taggard and E. C. Tims. 1924. The Sugarcane Disease Situation in 1923 and 1924. Louisiana Bulletin 191.

3. Edgerton, C. W., E. C. Tims. 1927. Investigations on the Sugarcane Disease Situation in 1925 and 1926. Agricultural Experiment Station Bulletin 197.

4. Hebert, Leo P. 1963. Cultural Practices in Sugarcane. Proc. American Society of Sugarcane Technologists. Vol. 10. 1963 pp. 19-24

5. Hebert, Leo P. 1964. Culture of Sugarcane for Sugar Production in Louisiana. Handbook No. 262. U.S.D.A.

6. Hebert, Leo P. and R. J. Mathern. 1956. Comparison of the usual off-barring with a modified method of off-barring on yields of sugarcane in Louisiana. Sugar Bulletin 35 (9):119-120, 123.

7. King, N. J., R. W. Mungomery and C. G. Hughes. 1953. Australia. Manual for cane growing. Angus and Robertson - London.

8. Lea, D. M. 1952. Economic aspects of sugarcane production of large farms in Louisiana. Thesis (M.S.) L.S.U.

9. Lindsey, Morris Maurice. 1950. An economic study of the production of sugarcane on family type farms in Louisiana under various levels of mechanization. Thesis (M.S.) L.S.U.

10. Loupe, Denver T. 1956. Extension Aspects of Weed and Grass Control in Sugarcane in Louisiana. Sugar Bulletin 34(9) pp. 128-130.

11. Maier, Emile. 1952. Story of Sugarcane Machinery. Sugar Journal 1952, A. Specialist Issue.

12. McPherson, W. W. and J. N. Efferson. 1940. A farm management and cost study on 500 family sized farms in the Louisiana sugarcane area in 1938. Agri. Expt. Station Bulletin 314.

13. Moore, . 1853. Sugar Culture in Louisiana. DeBows Review 14: 507-8.

14. New Orleans Association of Commerce. The Agricultural Situation in the New Orleans Trade Area 1926. A. Bulletin.

15. Ponder, H. G. 1957. Labor and Material Requirements for the Major Farm Enterprises in the Louisiana Sugar Area. Thesis (M.S.) L.S.U.

16. Rodrigue, S. J. 1963. Producing sugarcane in Louisiana without putting it on the off-bar. Proc. American Society of Tech. Vol. 10. pp. 39-44.

17. Ruess, G. H. 1930. An economic study of the factors affecting farm organization and power utilization. Agric. Expt. Station Bulletin. 215.

18. Stamper, Ernest R. and Denver T. Loupe. 1964. Recommendations for the control of Johnson grass seedlings and Johnson grass in Louisiana sugarcane. Sugar Journal Vol. 26; No. 11, pp. 50-51.

19. Stamper, Ernest R. and Denver T. Loupe. 1964. Recommendations for the control of Johnson grass seedlings and Johnson grass in Louisiana sugarcane. Sugar Bulletin. Vol. 42-No. 1C. pp. 118-121.

20. Stamper, Ernest R. 1965. Chemicals used as herbicides for Johnson grass seedlings, other weeds and grass control in Louisiana sugarcane. Proc. XII Congress ISST. In Press.

21. Stamper, Ernest R. 1965. Chemicals and Combinations of Different Chemicals used for Weed and Grass Control in Louisiana Sugarcane Fields. XII Proc. Congress ISST. 1965 (In Press).

22. Stevens, Douglas P. 1964. Field Day West Baton Rouge Parish.

23. Stubbs, W. C. 1891. Results of field experiments with sugarcane. Agri. Expt. Station Bull. No. 6.

24. Stubbs, W. C. 1900. Cultivation of sugarcane Part 1. Sugarcane. A treatise on its history, botany, and agriculture.

25. Stubbs, W. C. 1902. Sugar making on a small scale. Agric. Expt. Station Bulletin No. 5.

26. Taggart, W. G. and E. C. Simon. 1930. A brief discussion of the history of sugarcane, its culture, breeding, harvesting, manufacturing and products. Dept. of Agric. and Imm. of Louisiana. 21 pp.

27. Wasson and E. R. McCrory. 1949. Louisiana Sugarcane Extension Bulletin No. 15.

28. Wilkinson, R. A. 1847. Cultivation of Sugarcane. De Bow's Review, Vol. 3, pp 244-249.

MOVING CANE STORAGE AWAY FROM THE MILL - IS IT FEASIBLE?

Harold A. Willett
Cameco Sales Corp.
Thibodaux, Louisiana

I visited Louisiana during the harvest season for many years before making it my permanent home. I was always terribly impressed with the field layout, cultivation, cutting and loading. But, and this is a big but, I never saw anything as poor and inefficient as our transport and cane handling system from the field to the mill carrier. It is slow, it is costly and it is inefficient.

When one talks to members of our sugar industry, all one hears is the tremendous cost of cutting cane that is down. I agree this is a serious problem but if one could get facts and figures to compare the added costs of cutting this cane in the past ten years to the costs of trucks waiting at the mill, wagons and crews waiting on trucks, chain sling damage and replacement, and sugar lost in a storage pile, he would be appalled at his findings. A sound profitable sugar industry in Louisiana is more dependent on finding a solution to the material handling problem than the cutting problem.

Unfortunately, I came here today without a solution to our problem. I came here to analyze our problem, and I hope I will make people aware of it so that all minds are directed to it so that a solution can be found soon. Time is running out on us and we must act fast.

Other sugar areas that have felt the financial pinch have dug in and found a solution to their problem. Hawaii has a system that is good for their conditions. Florida has done a good job on theirs. In other sugar growing areas they are working on the handling problem and are approaching a solution. It would be easy if we could take one of these systems and

put it down here and it would work, but because of our severe conditions it won't. We must find an answer of our own that will fit our conditions and needs.

Let's look at some of the problems that we have that makes our area different from others:

1. With a sixty to seventy day harvest season our return on investment for any transport machinery purchased is almost impossible.
2. Our soils are so heavy that when they get wet we need either a powered wheel or one with a large radius so that it will roll. Even with the size wheel we have now I have, many times, seen wheels act as sleds. This requires more traction effort to pull the load through the field.
3. Because of our poor return on investment, it is almost impossible to purchase a special haul cane power unit as is done in Florida and Hawaii. We almost have to use our cultivation tractors for harvesting.
4. Most of our field derricks are designed for a 3 to 4 ton load and are made for sling unloading.
5. Because of our low tonnages and poor mill distribution, a great percentage of our cane has to be hauled on public roads for great distances.
6. We have a tremendous investment in derricks at our mill which we either have to use or throw out and take a loss on.
7. And lastly, we have waited too long.

Now that we have looked at the problems that we have, that other people don't have and we have felt sorry for ourselves, let's look at some of the requirements that are needed for a good system for Louisiana.

These are our ideas and if we are wrong we hope we are corrected so that our efforts are not lost on an impractical system.

1. We feel that a system should be designed so that there is a sufficient surge between each operation. With this, a breakdown or a build-up in one operation does not affect the other operations. The first surge can be taken between the harvester and loader. A sufficient amount of cane is cut ahead so that the loader doesn't have any lost time. With the equipment we have now, in normal years, this is only a matter of well maintained equipment and good supervision. A second surge can be taken between the cane wagon and the truck. This means that cane has to be stored in cane wagons or around a derrick, and with the size cane wagons we have, it would be quite expensive to store any tonnage of cane in them. For farms with fairly large quotas (300 to 400 tons) it would pay to have a mobile dragling equipped with a grab to store cane. It is possible to store 300 tons around a dragline, still leaving an area open to load trucks. With this type of storage or surge, the cane wagons could be converted to chain net unloading and all slings eliminated. It would also permit full utilization of the field equipment. The amount of field equipment could be reduced, and this would offset the extra cost of the dragline. Another possibility would be to store your cane around the dragline in the daytime and haul it to the mill at night when there is no waiting at the mill. If some of my calculations are right, a truck would be able to make about three times as many trips if he had no lost time in waiting. I should add that if this system were adopted, the trucks would have to be

net or side unloaded as you could never use slings on grab loaded cane. It is also almost a must that they be unloaded onto a cane table.

The third possibility is storage of cane in extra trailers. This is being successfully accomplished in Hawaii and will be tried for the first time at Lula this year. If trailers can be built or purchased cheaply enough, this system has its merits. Cane is stored in small enough units so that deterioration does not become a problem. It cuts down on the number of trucks and truck drivers.

In both the field derrick storage and trailer storage there is one advantage that I must mention, this is that the farmer would have control on how old his cane is before it is ground, while now it may stay in the stack for quite a while if there is not good supervision in the cane yard.

The last surge, and to my thinking the worst, is mill yard storage. In one mill that I operated, we were able to raise the yield almost a half a point by doing away with cane in a mill yard storage pile. The equipment used for this storage is expensive to buy, is expensive to operate and the labor around the mill derrick is always the highest paid. The ideal situation is about two hours grinding stored at the mill. This cane would be turned over daily and would always be kept fresh.

To get to this ideal situation cane would have to flow to the mill 24 hours a day. I know many will say this is impossible. This was said to me when I started night hauling in Puerto Rico, but it was proven later that the night shift was always more productive than the day shift. After doing it in harvesting and getting such good results, we went into it in cultivation and land preparation. The results were that we were able to

do the amount of work with one-half the equipment.

One will always bring up the weather factor when a night operation is discussed. I operated a night shift harvesting operation in Hawaii where we averaged 140 inches of rain per year. To overcome this weather factor we would have to prepare our equipment for night operations. For a tractor it means a cab and heater which costs around $400.00. This is much less than the cost of extra tractors.

In Conclusion:

<u>We recommend the following</u>:

1. Cane cutting should be done on a one shift basis and sufficiently ahead so that a loader never has to wait for cane.
2. That the Louisiana cane cart be modified for net type unloading and be worked at least 16 to 20 hours a day.
3. That the cane be unloaded onto the ground at the unloading transfer station. That this be the main surge point.
4. That the cane be reloaded into a truck with a grab equipped dragline.
5. That this phase of operation be a 24 hour operation.
6. That all trucks be equipped for net unloading.
7. That all mills be prepared to accept this type of truck onto their feeder table.
8. That a committee be formed to set standards on height of trucks, types of manifolds so that one can unload at any mill of case of a breakdown.

Thank you for giving me the opportunity to speak to you and I would welcome a discussion on any of my ideas.

INCLINED FEEDER TABLE AND DUMPING SYSTEM AT THE RACELAND FACTORY

J. L. Mathews, Manager
Raceland Sugar Factory
Raceland, Louisiana

The Raceland Factory at the time it was acquired by the South Coast Corporation, was a two tandem factory. It was decided to work toward eliminating one tandem and increase the grinding rate. This would require a new tandem and changes in the cane yard.

In 1964 the new tandem was completed and the cane yard changes were started.

Sling cane had been received and piled or put on the mill with a 100 foot derrick, a dragline and a trolley system.

Box trucks and field wagons equipped with chain baskets were unloaded, piled or put on the mill with an 80 foot derrick and 2 pit dumping stations. One pit station consisted of an 80 foot derrick with a grab, a dragline and a 15 ton pit. The other pit station consisted of a grab on a trolley system, a dragline and a 15 ton pit.

The draglines dumped the box trucks and field wagons. The derrick piled the cane for night grinding and the grab put cane on the mills as dumped.

In 1964 these two pit stations were combined into one station, eliminating the pits, using one dragline to unload the boxes and field wagons onto an inclined feeder table.

The 80 foot derrick now unloads sling cane in the bull pen for night grinding. Putting the piled cane on the inclined feeder table at night.

The box trucks have two compartments 8 feet x 8 feet x 16 feet. The nominal total capacity is 25 tons. The compartment walls and division walls are solid plate. The running gear is the usual cane trailer arrangement.

Each compartment has a chain basket. A basket is made up of five chains 25 feet long. There are six cross chains approximately 12 feet long crossing the five long chains and attached to the long chains forming the basket.

One end of the basket is attached to the top of a compartment. The basket is spread over the bottom of the compartment from wall to wall and end to end. The free end of the basket is attached to a 3 inch pipe that serves as a lifting bar. This bar rests in brackets at the top and outside of the compartment. The lifting bar is approximately 6 inches from the truck wall.

The field carts have the same general arrangement as the large boxes.

The box trucks and carts are loaded in the fields and hoists in the usual manner.

The inclined feeder table at Raceland is 56 feet long, 18 feet wide and installed at an angle of 16°. The loading end is 24 inches above ground level. The discharge end rests on the top of the cane conveyor at a point 16 feet above ground level. The walls are 60 inches high. The full capacity of the table is 35 tons.

The bottom has six parallel slots the entire length of the table. These slots have sides made of 4 inch channels back to back, separated about 5 inches. The top of the channels are flush with the bottom of the table. The chain runs on a rail in the bottom of these slots.

There are six strands of C111 chain with G6 attachments every 6th link. The flights riveted to these attachments are ½ x 2-½ x 6. The top of the chain is level with the table bottom, so the chain will not carry any cane load, only pushing the cane.

A 7 x 10 twin steam engine drives the feeder table through a

sprocket, chain and gearing reduction. The chain speed is approximately 15 feet per minute.

Guard rails are installed at the dumping end of feeder table to guide the trucks and to hold carts from tipping while being unloaded. A hook chain is set in the concrete for holding down the box truck while being emptied. This is necessary as the truck will lift and break the pin in the fifth wheel.

The dumping is done by a drag line with a 10 ton capacity. The boom is over the center of the compartment and the boom end as far over the compartment as necessary to empty the basket. A hook bar made of 8 inch channel about 8 feet long with hooks cut from ½ inch plate welded at approximately 18 inch intervals along the channels. The bar is weighted to give better control of the hook bar.

This bar is hung at its center to a sheave with 2 part reeving. The bar is controlled in its movement toward and away from the trucks by a single tagline. This will be replaced for the 1965 crop by a 2 line Tag Master. This will give better control in placing the hook bar. The operator has to bump the bar to start a slight spin and catch the lifting bar "on the fly". The Tag Master should eliminate this.

When a box is to be dumped, it is brought up on the slab as close as possible to the guard rails. The rear compartment is dumped first. This leaves the weight of the front compartment on the tractor for traction. The hold down chain is hooked to the box by the driver. The dragline operator hooks the lifting bar on the basket and pulls the basket up, dumping the cane onto the feeder table. When the basket is empty, it is lowered into the box and the lifting bar put into its holders by the dragline bar. The hook bar is lowered away from the lifting bar, the

tag line pulls the hook bar out of the way, the front box is then backed into place and the dumping done in the same way.

Fields carts are dumped in the same manner but it is not necessary to hold down the carts. They do not tip. It is not necessary to dump the rear cart first.

The actual time to dump a box truck after it has been placed on the slab averages 3.86 minutes for both compartments. The average time for both carts is 1.80 minutes.

The total time that a box truck is on the cane yard from weighing in to weighing out empty was a maximum of 32 minutes. The minimum was 5 minutes. The average was 19.8 minutes.

Due to the large number of field carts, ten or twelve carts (field) are dumped for each 25 ton box truck.

The most that we have put on the inclined feeder table during a 10 hour unloading day was approximately 2000 tons. This was 700 tons from box trucks and 1300 tons from field carts.

This was about a normal number of boxes and carts but the cane weight was very low. In 1963 the boxes averaged 21.29 tons, in 1964 the boxes averaged 18.75 tons. The 1963 cart weight average was 3.205 tons and in 1964 they averaged 2.59 tons.

CANE HANDLING AT CAJUN SUGAR COOPERATIVE, INC.

Luis A. Suarez
Plant Manager and Felix Serrate, Electrical Engineer

Cajun Sugar Cooperative, Inc.
New Iberia, Louisiana

The handling of cane at Cajun Sugar Cooperative, Inc. is accomplished with five-two ton hoists, five-ten ton hoists, and two-ten ton overhead traveling cranes.

We use a system similar to the Hilo type at our Factory to unload the cane. Economy was the primary reason that this system was adopted.

The cane trailers used were the conventional ones with modifications. The length of the trailers is 34 feet with a 20 inch partition at the middle, giving two compartments of about 16 feet apiece, also used were a few cane trailers having three compartments. These standard trailers are 13 feet total height and are 9 feet deep. We use 5 chains in each compartment with 3 chains across. All chains at one end are anchored to one side of the trailer and at the other end they are bolted to a 3 inch extra heavy pipe, that rests on hooks prepared for the same. Conventional tractor carts were also handled by our unloading system.

As the truck gets in one of the five unloading hoists, the 10 ton, five speed, hoists with a special hook grabs the pipe. There is a two ton hoist to pull the main hook system in position. As soon as the pipe is hooked, the 10 ton hoist pulls the same, and drops the cane in the cane yard. For this operation it takes from 2½ to 3 minutes.

The two compartment trailers carry 25 tons of cane. The three compartment trailers carry 36 tons of cane. Each compartment is unloaded separately; we do not unload two compartments at one time.

One of the stations unloads the trucks directly on the feed table and

from there the cane goes into the mill. Without interruptions, the unloading of trucks at the feed table keeps the mill grinding at the rate of 4,000 tons to 4,250 tons per day, depending on the condition of the cane.

The cane receiving area has a capacity of 3,500 tons to 4,000 tons.

The ramp where the trucks unload is made of a good dirt fill and was surfaced with asphalt for the 1964 crop. We felt that the whole ramp would settle after the crop and would have to be rebuilt. This year the whole ramp was rebuilt and a 9 inch reinforced concrete slab poured.

The P & H Traveling Cranes have the following specifications:

The span is 80 feet with a total lift of 40 feet. The steel structure is 310 feet long. It has a Farval "one-shot" lubricating system.

The speeds are as follows:

Holding Hoist: 60 feet per minute

Closing Hoist: 60 feet per minute

Bridge: 400 feet per minute

Trolley: 250 feet per minute

The trolley has two independent hoists for handling a four line sugar cane grab. The weight of the grab is five tons and it can handle five tons of cane.

The overhead cranes are operated by four motors. One for traveling, one for the trolley, one for hoisting and one for closing and opening the grab.

All the motors have five speeds and are wound rotor induction motors. If the operator chooses to push control lever to fast position, the speed changes automatically using the variable induced voltage in the wound rotor as a controlling medium. Naturally, the operator can choose any of the

five speeds available by positioning the speed control lever, and when he does this the motor will always go through all the proceeding speeds until it reaches the chosen one. The system will not only give the required torque at different loads and speeds, but also protects the motor from overloading.

When lowering the grab the hoisting motor serves as a braking medium so as to avoid any damage to the grab. This operation is so successful that a 4 inch reinforced concrete slab at the cane storage area was not damaged.

THE SIDE DUMP SYSTEM OF SUGAR CANE HANDLING

Larry G. Fowler
J & L Engineering Co., Inc.
Jeanerette, Louisiana

Sugar cane producers and factory men are now realizing the definite need for more efficiency in the sugar cane industry. This need will obviously become more evident in the near future with the quota restrictions recently applied to curtail increases of cane production, and the increasing demands for higher wages for farm and factory workers. At present, additional dividends through higher volume production, are not attainable with the imposition of the quota system.

Decreasing trends in the price of sugar and the demands of labor couple to indicate perspectively limiting profit forecasts in future sugar cane crops for the producer as well as the factory. Considerable effects could possibly arise from this situation unless measures are taken to maintain or increase profit levels through the reduction of present equipment usage and operational costs.

One area in the Louisiana sugar cane industry within which the amount of equipment and operational expenses can definitely be reduced is in the handling of sugar cane from the field to the factory.

During the past few years, J & L Engineering Co., Inc., has made several feasibility studies, and has put into operation, modern and efficient systems of sugar cane handling in both Florida and Louisiana, all of which utilize the side dump method of handling.

This paper will concern itself with this type of handling system, however, we will endeavor to point out the advantages of the side dump system over other systems presently used in Louisiana. Due to time limitations, we will not discuss the harvesting operation, but will

concentrate our efforts on the handling of cane from the field loader to the mill cane carrier.

In order that facts and figures might seem more realistic, let us set up a hypothetical system of handling for a typical Louisiana sugar factory. Figure 1 shows a typical mill yard layout and traffic patterns of a conventional handling system of a Louisiana sugar cane factory of the following specifications:

Grinding rate of 3,600 short tons in 24 hours or approximately 150 tons per hour. Sixty (60) percent of cane delivered by highway trailers at an average distance of 15 miles; and forty (40) percent by cart haul at an average distance of 3 miles. Two revolving type derricks with horizontal booms of 60 feet and trolleys thereon are used to unload, and store cane during the 10 hour hauling period. These derricks supplement mill feed during the day and feed the mill from the storage piles during the night. A dragline or crane is located adjacent to the feed table to unload and feed the mill during the hauling period.

Figure 2 depicts a layout of the same Louisiana sugar factory after converting to the side dump system of handling. Specifications are as follows:

The grinding rates and the hauling requirements remain the same with the exception that side dump units replace the conventional hauling units. One hydraulic unloading station is installed for direct feed to the mill on an inclined feeder conveyor. Two hydraulic dumping stations are added for unloading into storage. One 80 foot traveling bridge crane of 10 ton capacity equipped with 5 ton capacity grab is used to move cane from the storage dumping area into a storage pile during the 10 hour unloading period, and feed the mill during the night operation. The bridge crane always keeps the feeder table full to supplement direct unloading, if necessary. Length of bridge crane runway is 220 feet.

TRANSPORTING

In order to proceed into the transporting phase of this system, consideration should first be made regarding the type of side dump equipment which would be used to haul cane from the field to the mill. Up until this time, there was little choice in selecting a side dumping cart, since only one model was available. However, the complexion of this situation has changed with the introduction of a new side dump cart, model C20,000 into the sugar cane industry for the 1965 crop season.

The C20,000, unlike the present tandem C11000 cart used in Louisiana, is a two wheeled cart which can be towed in trains of two, and will transport more cane per trip more economically than the present side dump cart.

Figure 3 compares the new C20,000 cart with the C11000 and chain net carts; and readily shows that by volume comparisons, a combination of two C20,000 carts can haul nine tons of whole stalk cane; 2.5 and 2 tons over that of the C11000 and the chain net carts respectively. Therefore, for this particular system C20,000 side dump carts towed in trains of two, and A2000 side dump trailers will be used for transporting purposes.

To determine the necessary equipment required for transporting, it must first be determined at what rate cane must be received at the mill site. This is governed by the mill grinding capacity, which in the factory under consideration is 3,600 tons per day or 150 tons per hour.

Due to the possibility of delivery delays, an additional 10% of the daily mill capacity should be delivered at the mill site to compensate

for breakdowns, inclement weather, efficiency factors, or other delays inherent to any transporting system. Therefore, for system design purposes, 3,960 tons per day or 165 tons per hour is assumed to be transported to the mill site.

It is stated in the factory specifications that 40% of the cane is hauled by cart and the remaining 60% by trailer, indicating that 66 and 99 tons/hr. would be transported for mill feed by carts and trailers respectively.

In order that the number of hauling units may be determined, the hauling capabilities of both carts and trailers must be known. Figure 4 gives a breakdown of the transporting cycles and hauling capabilities of these units, and shows that in this particular system one train of two C20,000 side dump carts can haul 14.35 tons of cane per hour, and 15.5 tons per hour by one A2000 side dump trailer.

With a required cart mill feed rate of 66 tons/hr. and a cart hauling rate of 14.35 tons/hr., 5 hauling units or <u>10 C20,000 carts</u> can supply 40% of the mill feed requirements. By the same reasoning, with a required trailer mill feed rate of 99 tons/hr. and a trailer hauling rate of 15.5 tons/hr., <u>7 A2000 trailers</u> can supply the additional 60% of the mill feed requirements.

Since direct mill feeding occurs only during the daylight hauling period of 10 hours duration, then 1,650 tons of the daily mill rate is consumed in this operation, leaving 2,310 tons to be stored for night mill feed. To store this quantity of cane during the hauling period, a transporting rate of 231 tons/hr. is required.

By repeating the same calculations as for mill feed, however, considering a mill storage transporting rate of 231 tons/hr., it is

FIGURE 4

TRANSPORT CYCLE & HAULING CAPACITY

Two (2) C20,000 Side Dump Carts

OPERATION	TIME REQUIRED
Field Load 9 Tons with 50 Ton/Hr. Grab Type Loader (4.5 Tons/ Compartment)	10.80 Min.
Travel to Factory from Field (3 Miles @ 16.5 MPH)	10.90 Min.
Weigh In @ Factory (Loaded)	1.00 Min.
Travel from Scale to Unloading Station	1.00 Min.
Unload or Dump (2 Compartments)	2.00 Min.
Return to Scale	1.00 Min.
Weigh Out (Empty)	0
Return to Field	10.90 Min.
Total Transport Cycle Time=	37.60 Min. or .626 Hrs.
Hauling Capacity = 9 Tons/ Trip ÷ .626 Hrs./ Trip = 14.35 Tons/Hr.	

A2000 SIDE DUMP TRAILER

OPERATION	TIME REQUIRED
Load 24 Tons @ Field Derrick	28.00 Min.
Travel to Factory From Field Derrick (15 Miles @ 30 MPH)	30.00 Min.
Weigh in @ Factory (Loaded)	1.00 Min.
Travel From Scale to Unloading Station	1.00 Min.
Unload or Dump (2 Compartments)	2.00 Min.
Return to Scale	1.00 Min.
Weigh Out (Empty)	0
Return to Field Derrick	30.00 Min.
Total Transport Cycle Time =	93.00 Min. or 1.55 Hr.
Hauling Capacity = 24 Tons/Trip ÷ 1.55 Hrs./Trip = 15.5 Tons/Hr.	

FIGURE 4 CONT'D

C11000 SIDE DUMP CART

OPERATION	TIME REQUIRED
Field Load 6.5 Tons with 50 Ton/Hr. Grab Type Loader	7.80 Min.
Travel to Factory from Field (3 Miles @ 16.5 MPH)	10.90 Min.
Weigh In @ Factory (Loaded)	1.00 Min.
Travel from Scale to Unloading Station	1.00 Min.
Unload or Dump (1 Compartment)	1.00 Min.
Return to Scale	1.00 Min.
Weigh Out (Empty)	0
Return to Field	10.90 Min.
Total Transport Cycle Time =	33.60 Min. or .56 Hr.

Hauling Capacity = 6.5 Tons/Trip ÷ .56 Hrs./Trip
= 11.6 Tons/Hr.

FIGURE 5

TRANSPORT CYCLE & HAULING CAPACITY

Two (2) Chain Net Carts

OPERATION	TIME REQUIRED
Field Load 7 Tons with 50 Ton/Hr. Grab Type Loader (3.5 Tons/Cart)	8.4 Min.
Travel to Factory from Field (3 Miles @ 16.5 MPH)	10.9 Min.
Weigh In @ Factory (Loaded)	1.0 Min.
Travel from Scale to Unloading Station	1.0 Min.
Unload (2 Compartments)	4.0 Min.
Return to Scale	1.0 Min.
Weigh Out (Empty)	1.0 Min.
Return to Field	10.9 Min.
Total Transport Cycle Time =	38.2 Min. or .637 Hrs.
Hauling Capacity = 7 Tons/Trip ÷ .637 Hrs./Trip = 11 Tons/Hr.	

CHAIN NET TRAILER

OPERATION	TIME REQUIRED
Load 24 Tons @ Field Derrick	28.0 Min.
Travel to Factory from Field Derrick (15 Miles @ 30 MPH)	30.0 Min.
Weigh in @ Factory (Loaded)	1.0 Min.
Travel from Scale to Unloading Station	1.0 Min.
Unload (2 Compartments)	4.0 Min.
Return to Scale	1.0 Min.
Weigh Out (Empty)	1.0 Min.
Return to Field Derrick	30.0 Min.
Total Transport Cycle Time =	96.0 Min. or 1.6 Hr.
Hauling Capacity = 24 Tons/Trip ÷ 1.6 Hrs./Trip = 15 Tons/Hr.	

FIGURE 6

TRANSPORT CYCLE & HAULING CAPACITIES

Two (2) Conventional Carts

OPERATION	TIME REQUIRED
Field Load 8 Tons with 50 Ton/Hr. Grab Type Loader (4 Tons/Cart)	9.6 Min.
Secure Sling Chains (3 Chains/Cart)	4.0 Min.
Travel to Factory from Field (3 Miles @ 16.5 MPH)	10.9 Min.
Weigh In @ Factory (Loaded)	1.0 Min.
Travel from Scale to Unloading Station	1.0 Min.
Unload	6.0 Min.
Return to Scale	1.0 Min.
Weigh Out (Empty)	1.0 Min.
Return to Field	10.9 Min.
Total Transport Cycle Time =	45.4 Min. or .757 Hrs.

Hauling Capacity = 8 Tons/Trip ÷ .757 Hrs./Trip
= 10.4 Tons/Hr.

CONVENTIONAL TRAILER

OPERATION	TIME REQUIRED
Load 24 Tons @ Field Derrick	28.0 Min.
Travel to Factory from Field Derrick (15 Miles @ 30 MPH)	30.0 Min.
Weigh in @ Factory (Loaded)	1.0 Min.
Travel from Scale to Unloading Station	1.0 Min.
Unload	18.0 Min.
Return to Scale	1.0 Min.
Weigh Out Time	1.0 Min.
Return to Field Derrick	30.0 Min.
Total Transport Cycle Time =	110.0 Min. or 1.83 Hrs.

Hauling Capacity = 24 Tons/Trip ÷ 1.83 Hrs./Trip
= 13.1 Tons/Hr.

found that 7 hauling units or 14 C20,000 carts and 9 A2000 trailers fulfill the storage transporting requirements.

It should be pointed out at this time, that for comparative purposes, a perfect system in all cases has to be assumed in order that fair treatment can necessarily be given to each. In a perfect system, as should be understood, no delays or waiting times are credited to any system. All travel rates are the same for similar units and times required for moving the hauling units into unloading positions are necessarily considered to be the same.

An inspection of Figures 5 and 6 provides the transport cycles and hauling capabilites of the chain net and conventional transporting units for the same factory under consideration. By using these hauling rates and by completing the same calculations as those of the side dump system, the number of required hauling units is obtained. Figure 7 shows the results of these computations; the number of carts and trailers per system necessary to supply cane to the same factory.

FIGURE 7

TYPE OF HAULING UNIT	MILL FEED	NUMBER REQUIRED MILL STORAGE	TOTAL
C11000 Side Dump Cart	6	8	14
A2000 Side Dump Trailer	7	9	16
C20,000 Side Dump Cart	10	14	24
A2000 Side Dump Trailer	7	9	16

FIGURE 7 CONT'D

TYPE OF HAULING UNIT	MILL FEED	NUMBER REQUIRED MILL STORAGE	TOTAL
Chain Net Carts	12	18	30
Chain Net Trailers	7	10	17
Conventional Carts	14	18	32
Conventional Trailers	8	11	19

From this chart it can be seen that four additional chain net hauling units and seven conventional hauling units are required over that of the side dump system (utilizing the C20,000 carts) to transport the same quantity of cane. It should be noted that a side dump system with the C11000 tandem carts has been included in this chart for comparison. Although somewhat better than the chain net & conventional, it also fails to reach the achievements of the C20,000 carts with reference to the number of hauling units required.

Considering travel times, weighing times, and positioning times equal for similar hauling units (which was stated above as requirement for impartial comparison) of the side dump, chain net, and conventional systems it is found that the favoring factor of the side dump system over all others lies in the mill yard phase of handling. The chart in Figure 8 gives a breakdown of the time each of the units in question remains in the mill yard.

FIGURE 8

UNIT	WEIGH IN TIME MINUTES	TRAVEL FROM SCALE TO UNLOADING STATION MINUTES	UNLOAD MIN.	RETURN TO SCALE MIN.	WEIGH OUT IN MIN.	TOTAL IN MIN.
C11000 Side Dump Cart	1.0	1.0	1.0	1.0	0	4
C20,000 Side Dump Cart	1.0	1.0	2.0	1.0	0	5
A2000 Side Dump Trailer	1.0	1.0	2.0	1.0	0	5
Chain Net Carts	1.0	1.0	4.0	1.0	1.0	8
Chain Net Trailer	1.0	1.0	4.0	1.0	1.0	8
Conventional Carts	1.0	1.0	6.0	1.0	1.0	10
Conventional Trailer	1.0	1.0	18.0	1.0	1.0	22

As can be seen, the total mill yard time for a C20,000 side dump cart is 5 minutes, where as, the chain net carts remain in the mill yard almost twice as long, this difference also proving true of the side dump to chain net trailers. The mill yard time differential between these systems is contributed to two factors, namely, unloading time and weighing out time.

The hydraulic dumper unit incorporated in the side dump system is capable of completing one dumping cycle in slightly less than one minute, while the "Hilo" or chain net dumper unit requires two full minutes. In the selection of a bulk handling system, the dumper cycle speed is a factor which should be considered, since the dumper unit capacity is largely responsible for the number of transporting units required for both mill feed and storage.

Weighing out time at the factory for the side dump units can be minimized to the first and last loads of the day, since all of the entrained material is removed from these units during the dumping operation.

However, this is not true of the chain net units, because a mat of cane remains in the bottom of the carts and trailers due to dropping of cane and trash through the chain mesh during the unloading operation.

The times required to position a vehicle for unloading in the side dump and chain net systems, although practically the same, have not been considered, since these positioning times in an actual operation are wholly dependent on the efficiency of each individual driver and dumper operator. To include such times would prove comparatively unfair to either or both systems.

With the exception of a very few installations, all of the mainland sugar cane harvesting operations are carried on during the daylight hours. Therefore, the mill yard unloading facilities are required to handle not only the cane for mill feed but also that required for storage, which is received at a rate of almost twice the mill grinding rate.

As everyone realizes, the mill yard is conceivably the "bottleneck" in the conventional Louisiana sugar cane factory. The long waiting and unloading times are primarily due to the slow operating features of the revolving type derrick and the handling of each individual bundle of cane delivered.

The layout in the mill yard of Figure 2 clearly defines the side dump equipment necessary to handle 3,600 tons of cane per day, namely,

1 inclined feeder conveyor

1 unloading ramp

1 hydraulic dumping station for mill feed

2 hydraulic dumping stations for mill storage

1 traveling bridge crane of 80 foot span

You will note in the selection of the mill yard equipment, a bridge crane replaces the revolving type derricks. This selection is based on the contention that an efficient system of bulk handling from field to factory could not be fully achieved unless a similarly efficient means of storing cane in the mill yard is provided.

Proper scheduling of the transporting units with reference to arrival at the mill site is important to the successful operation of the side dump handling system, since unforeseen delay or waiting time tends to

lower efficiency. It can be said that in the side dump or any other type of bulk handling system, speed is of the essence.

With speed and efficiency in mind, it can easily be understood that the traffic pattern of the transporting vehicles at the factory is an important factor contributing to the successful operation of a bulk handling system. A good example of this can be seen in comparison of Figures 1 and 2. A simple traffic flow pattern is shown in the side dump system, while a complex pattern results in the conventional system. A crisscross and undefined traffic pattern is susceptible to creating confusion, loss of time, and possible accidents. This is consequently true in all conventional systems, because of the circular operation of the revolving type derricks.

SYSTEM COSTS

To cost conscious producers and factory men, the selection of a bulk handling system is largely dependent on investment and operational cost of the system.

In order that costs may be compared, the entire system cost per ton of the factory discussed in this paper is shown in Figures 9 through 12. A recap of these costs is shown below.

	SIDE DUMP SYSTEM WITH C20,000 CARTS	SIDE DUMP SYSTEM WITH C11,000 TANDEM CARTS	CHAIN NET SYSTEM	CONVENTIONAL SYSTEM
Mill Feed Cost Per Ton	$.412	$.441	$.450	$.518
Mill Storage Cost Per Ton	$.422	$.442	$.496	$.534
Night Mill Feed Cost Per Ton	$.117	$.117	$.117	$.180
Total System Cost Per Ton	$.487	$.510	$.545	$.632

By comparing these costs, it is found that the side dump system, utilizing the C20,000 carts, has an advantage of 3.8 cents per ton over the chain net system and 10.6 cents per ton over the conventional system for mill feed alone. In over-all system costs, the side dump system betters the chain net and conventional systems by 5.8 and 14.5 cents per ton respectively.

If consideration is made as to the savings over a 70 day crop season for this particular factory, converting to the side dump system indicates a saving of $36,540.00 over the conventional system, and an annual savings of $14,616.00 over converting the same factory to the chain net system.

FIGURE 9

SYSTEM COST PER TON

SIDE DUMP SYSTEM WITH C20,000 CARTS

MILL FEED (10 Hours)

EQUIPMENT	HOURLY COST	DAILY COST
1- Inclined Conveyor (with operator)	$ 6.586	$ 65.86
1- Hydraulic Dumper Unit (with operator)	2.628	26.28
1- Unloading Ramp	1.150	11.50
10- C20,000 Carts @ $.213	2.130	21.30
5- Diesel Tractors (with driver) @ $3.229	16.145	161.45
7- A2000 Trailers @ $1.016	7.112	71.12
7- Truck Tractors (with driver) @ $3.761	26.327	263.27
TOTAL HOURLY COST	$62.078	
TOTAL DAILY COST		$620.78

COST PER TON @ 1500 TONS PER DAY $.412

MILL STORAGE (10 Hours)

2- Hydraulic Dumper Units (with operator) @ $2.628	$ 5.256	$ 52.56
14- C20,000 carts @ $.213	2.982	29.82
7- Diesel Tractors (with driver) @ $3.229	22.603	226.03
9- A2000 Trailers @ $1.016	9.144	91.44
9- Truck Tractors (with driver) @ $3.761	33.849	338.49
1- 80 ft. Bridge Crane & Structure (with operator)	14.769	147.69
TOTAL HOURLY COST	$88.603	
TOTAL DAILY COST		$886.03

COST PER TON @ 2100 TONS PER DAY $.422

NIGHT MILL FEED (14 Hours)

1- 80 ft. Bridge Crane & Structure (with operator)	$14.769	$206.77
1- Feed Conveyor Operator	1.500	21.00
1- Scrapper	1.250	17.50
TOTAL HOURLY COST	$17.519	
TOTAL DAILY COST		$245.27

COST PER TON @ 2100 TONS PER DAY $.117

MILL FEED TOTAL DAILY COST	=	$ 620.78
MILL STORAGE TOTAL DAILY COST	=	886.03
NIGHT MILL FEED TOTAL DAILY COST	=	245.27
TOTAL SYSTEM DAILY COST		$1,752.08

Total System Cost Per Ton @ 3600 Tons Per Day $.487

FIGURE 10

SYSTEM COST PER TON

SIDE DUMP SYSTEM WITH C11000 TANDEM CARTS

MILL FEED (10 Hours)

EQUIPMENT	HOURLY COST	DAILY COST
1- Inclined Conveyor (with Operator)	$ 6.586	$ 65.86
1- Hydraulic Dumper (with Operator)	2.628	26.28
1- Unloading Ramp	1.150	11.50
6- C11000 Carts @ $.495	2.970	29.70
6- Diesel Tractors (with Driver) @ $3.229	19.374	193.74
7- A2000 Trailers @ $1.016	7.112	71.12
7- Truck Tractors (with Driver) @ $3.761	26.327	263.27
TOTAL HOURLY COST	$66.147	
TOTAL DAILY COST		$661.47

COST PER TON @ 1500 TONS PER DAY $.441

MILL STORAGE (10 Hours)

2- Hydraulic Dumper Units (with Operator @ $2.628	$ 5.256	$ 52.56
8- C11000 Carts @ $.495	3.960	39.60
8- Diesel Tractors (with driver) @ $3.229	25.832	258.32
9- A2000 Trailers @ $1.016	9.144	91.44
9- Truck Tractors (with driver) @ $3.761	33.849	338.49
1- 80 ft. Bridge Crane and Structure (with operator)	14.769	147.69
TOTAL HOURLY COST	$92.810	
TOTAL DAILY COST		$928.10

COST PER TON @ 2100 TONS PER DAY $.442

NIGHT MILL FEED (14 Hours)

1- 80 ft. Bridge Crane & Structure (with operator)	$14.769	$206.77
1- Feed Conveyor Operator	1.500	21.00
1- Scrapper	1.250	17.50
TOTAL HOURLY COST	$17.519	
TOTAL DAILY COST		$245.27

COST PER TON @ 2100 TONS PER DAY $.117

MILL FEED DAILY COST	=	$ 661.47
MILL STORAGE DAILY COST	=	928.10
NIGHT MILL FEED DAILY COST	=	245.27
TOTAL SYSTEM DAILY COST		$1,834.84

Total System Cost Per Ton @ 3600 Tons Per Day $.510

FIGURE 11

CHAIN NET SYSTEM COST PER TON

MILL FEED (10 Hours)

EQUIPMENT	HOURLY COST	DAILY COST
1- Feeder Conveyor (with operator)	$ 5.112	$ 51.12
1- "Hilo" or Chain Net Dumper Unit (with operator)	4.743	47.43
12- Chain Net Carts @ $.191	2.292	22.92
6- Diesel Tractors (with driver) @ $3.229	19.374	193.74
7- Chain Net Trailers @ $.988	6.916	69.16
7- Truck Tractors (with driver) @ $3.761	26.327	263.27
1- Scrapper Tractor (with driver)	2.749	27.49
TOTAL HOURLY COST	$67.513	
TOTAL DAILY COST		$675.13
COST PER TON @ 1500 TONS PER DAY	$.450	

MILL STORAGE (10 HOURS)

EQUIPMENT	HOURLY COST	DAILY COST
2- Hilo or Chain Net Dumper Units (with operator) @ $4.743	$ 9.486	$ 94.86
18- Chain Net Carts @ $.191	3.438	34.38
9- Diesel Tractors (with driver) @ $3.229	29.061	290.61
10- Chain Net Trailers @ $.988	9.880	98.80
10- Truck Tractors (with driver) @ $3.761	37.610	376.10
1- 80 ft. Bridge Crane and Structure (with operator)	14.769	147.69
TOTAL HOURLY COST	104.244	
TOTAL DAILY COST		$1,042.44
COST PER TON @ 2100 TONS PER DAY	$.496	

NIGHT MILL FEED (14 Hours)

EQUIPMENT	HOURLY COST	DAILY COST
1- 80 ft. Bridge Crane & Structure (with operator)	$14.769	$206.77
1- Feed Conveyor Operator	1.500	21.00
1- Scrapper	1.250	17.50
TOTAL HOURLY COST	$17.519	
TOTAL DAILY COST		$245.27
COST PER TON @ 2100 TONS PER DAY	$.117	

MILL FEED DAILY COST	=	$ 675.13
MILL STORAGE DAILY COST	=	1,042.44
NIGHT MILL FEED DAILY COST	=	245.27
TOTAL SYSTEM DAILY COST		$1,962.84

TOTAL SYSTEM COST PER TON @ 3600 TONS PER DAY $.545

FIGURE 12

CONVENTIONAL SYSTEM COST PER TON

MILL FEED (10 Hours)

EQUIPMENT	HOURLY COST	DAILY COST
1- Feeder Conveyor (with operator)	$ 5.112	$ 51.12
1- Crane or Dragline (with operator & 2 Chain Handlers)	10.328	103.38
14- Conventional Carts @ $.135	1.890	18.90
7- Diesel Tractors (with driver) @ $3.229	22.603	226.03
8- Conventional Trailers @ $.642	5.136	51.36
8- Truck Tractors (with driver) @ $3.761	30.088	300.88
1/3- Cane Sling Cost Per Hour	1.350	13.50
1- Scrapper	1.250	12.50
TOTAL HOURLY COST	$77.757	
TOTAL DAILY COST		$777.57

COST PER TON @ 1,500 TONS PER DAY $.518

MILL STORAGE (10 Hours)

18- Conventional Carts @ $.135	$ 2.430	$ 24.30
9- Diesel Tractors (with driver) @ $3.229	29.061	290.61
11- Conventional Trailers @ $.642	7.062	70.62
11- Truck Tractors (with driver) @ $3.761	41.371	413.71
2- Rotating Derricks (with operator) @ $10.333	20.666	206.66
2/3- Cane Sling Cost Per Hour	2.700	27.00
6- Chain Handlers (3 per derrick) @ $1.25	7.500	75.00
1- Scrapper	1.250	12.50
TOTAL HOURLY COST	$112.040	
TOTAL DAILY COST		$1120.40

COST PER TON @ 2100 TONS PER HOUR $.534

NIGHT MILL FEED (14 Hours)

2- Rotating Derricks (with operator) @ $10.333	$20.666	$289.32
1- Feeder Conveyor (with operator)	5.112	71.57
1- Scrapper	1.250	17.50
TOTAL HOURLY COST	$27.028	
TOTAL DAILY COST		$378.39

COST PER TON @ 2100 TONS PER DAY $.180

MILL FEED DAILY COST	=	$ 777.57
MILL STORAGE DAILY COST	=	1,120.40
NIGHT MILL FEED DAILY COST	=	378.39
TOTAL SYSTEM DAILY COST		$2,276.36

TOTAL SYSTEM COST PER TON @ 3,600 TONS PER DAY $.632

Attention should be given to the fact that the cost of scrapping at the unloading stations enters into the costs of the chain net system in Figure 11. There might be some controversy as to the inclusion of this cost in a system evaluation; but since spillage at the unloading stations are inherent to all chain net systems, the cost of removal necessarily becomes a portion of the system operational costs. Even though these scrapping costs are omitted, the side dump system is still more advantageous by some 5.1 cents per ton, which undoubtably continues to remain a considerable annual savings.

One expense which is peculiar to the chain net system, but has not been included in the system cost, is the cost of cleaning the mat of cane from the bottoms of the hauling units. Should the removal of this cane be a daily occurance, then this cost should be directly added to the system costs; however, if this mat is not removed, it indirectly remains a cost to the system since the hauling unit volume is reduced by the volume of the entrained materials, thus, decreasing the "payload" per trip to the factory. Regardless of whether this is a direct or indirect cost, it still remains an operational expense, and thus, tends to increase the differences in system cost per ton.

As you have probably gathered from the foregoing discussion, the side dump system is not plagued with these problems of scrapping and cleaning. This is contributed to the unloading principle of the side dump units in which the tilting action of the cane containers removes all materials, without spillage, from the hauling units. For this reason, scrapping and cleaning costs are not included in the side dump system costs.

We are all aware that in dealing with a perfect system, the operating

costs and transporting equipment requirements would be somewhat lesser than would be expected in an actual operation, however, it should be pointed out that the requirements shown in this theoretical example factory would be only slightly increased for the bulk handling systems, but, in reality the equipment requirements of the conventional system are much greater than those illustrated. This is understandably true, because of the long waiting and tying up of equipment in the mill yard, which has a tendency to drastically elevate the overall system costs.

Even though a perfect conventional system is exemplified in this paper, the advantages of converting to a bulk handling system are many, and, it is certain that the amount of equipment, manpower, and most important, operational costs can be reduced by such a conversion.

Some thought has been given to the economic possibilities of converting to a bulk handling system and storing cane in trailers rather than utilizing bridge crane storage. In the mill described above approximately 74 trailers and 14 truck tractors would be required to store and transport only half of the daily mill requirements.

It is true that a portion of the required number of trailers would be available from a "carry over" of the conventional system, and these could easily be converted to the chain net unloading system, but, new trailers would still have to be purchased to complete the system.

The initial investment in converting and purchasing trailers for this particular storage system would closely parallel the initial investment of the bridge crane storage and could possibly be much greater, depending on the number of new trailers purchased. Above this, the selling point between the two methods of storage lies in the comparisons of the cost per ton of cane stored. The owning and operating costs of

the trailer storage is far greater than that of the bridge crane storage, therefore, the cost per ton of cane stored is definitely greater, which would economically rule out this method of storage.

The basis for compiling the above system costs stems from the owning and operating costs for each individual component of each system. These individual costs are shown in the appendix section of this paper.

FUTURE TRENDS

Insistent demands for better and more efficient farm machinery has brought about much research and development in the line of harvesting equipment. Future trends of sugar cane harvester manufacturers is toward machines which will both cut and load incumbent or straight cane in one operation.

The cut-load harvester will eliminate the present field loading operation and replace whole stalk with short cut cane, thus necessitating a change from the conventional to a bulk handling system in Louisiana.

The side dump system has proven to be the best method of handling short cut cane man has devised, and the factories which incorporate such a system are far ahead in looking toward more efficient and economical developments in the Louisiana sugar cane industry.

CONCLUSION

Time not permitting, I will not try to summarize this entire presentation, but will leave you with the following remarks.

The side dump system of bulk handling is not an experiment in the sugar cane industry, but a proven method of handling which is time saving, labor saving, and most important, the most economical method of bulk handling known in the sugar cane industry.

To clarify any misunderstanding which might be derived from this presentation, the side dump system does not have to be fully incorporated into a factory in a one step operation, on the contrary, it can be developed into the factory in several different phases and over any desired period of time.

I should point out that the system as presented in this paper will not be applicable to every factory situation, because of differences in mill capacities, mill yard layouts, and transporting requirements. However, a side dump system basically similar can be devised for any sugar factory in Louisiana.

DIESEL TRACTOR FOR CART TOWING

Estimated Hourly Owning & Operating Cost
(Allis Chalmers 190 or Equal)

List Price	$8,400.00
Tires	$ 400.00
Price Less Tires	$8,000.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $8,000.00 (Price Less Tires) ÷ 10,080 Dep. Hrs.	=	$ .794
Int., Ins., Taxes: (.05/$1000) x $8,400.00 List Price	=	$ .420
Total	=	$1.214

Hourly Operating Cost

Fuel: 3 GPH x $.16 Per Gal.	=	$ .480
Lube Oil-Engine: .03 GPH x $1.20 Per Gal.	=	$ .226
Lube Oil-Trans.: .01 PGH x $1.20 Per Gal.	=	$ .012
Grease: .06 Lb. Per Hrs. x $.20 Per Lb.	=	$ .012
Filters:	=	$ .030
Repairs: (30% Depreciation Per Hour)	=	$ .238
Tires: $400.00 Replacement Cost ÷ 6,000 Hrs.	=	$ .067
Operator's wage:	=	$ .950
Total	=	$2.015

Total Hourly Owning Cost	$1.214
Total Hourly Owning & Operating Cost	$3.229

TRUCK TRACTOR FOR TOWING TRAILERS

Estimated Hourly Owning & Operating Cost
(3 ton, single axle, gasoline, Chevrolet "6303" or equal)

List Price	$4,500.00
Tires	$ 770.00
Price Less Tires	$3,730.00
Depreciation (10 year life)	8,400 hrs.

Hourly Owning Cost

Dep.: $3,730.00 (Price Less Tires) ÷ 8,400 Dep. Hrs.	= $ .444
Int., Ins., Taxes: (.05/$1000) x $4,500.00 List Price	= $ .225
Total	= $ .669

Hourly Operating Cost

Fuel: 4.1 GPH x $.30 per gal.	= $1.230
Lube Oil-Engine: .041 GPH x $1.20 per gal.	= $ .049
Lube Oil-Trans.: .0136 GPH x $1.20 per gal.	= $ .016
Grease: .3 lb/hr. x $.20 per lb.	= $ .006
Filters:	= $ .030
Repairs: (30% Depreciation Per Hour)	= $ .133
Tires: $770.00 Replacement Cost ÷ 6,000 Dep. Hrs.	= $ .128
Operator's wage:	= $1.500
Total	= $3.092

Total Hourly Owning Cost	$ .669
Total Hourly Owning & Operating Cost	$3.761

C20,000 SIDE DUMP CART

Estimated Hourly Owning & Operating Cost

List Price	$1,500.00
Tires	$ 97.00
Price Less Tires	$1,403.00
Depreciation (15 year life)	12,600 hrs.

Hourly Owning Cost

Dep.: $1,403.00 (Price Less Tires) ÷ 12,600 Dep. Hrs.	= $ .111
Int., Ins., Taxes: (.05/$1000) x $1,500.00 List Price	= $ .075
Total	$ .186

Hourly Operating Cost

Repairs: (10% Depreciation Per Hour)	= $ .011
Tires: $97.00 Replacement Cost ÷ 6,000 Hrs.	= $ .016
Total	= $ .027
Total Hourly Owning Cost	$ .186
Total Owning & Operating Cost	$ .213

C11000 SIDE DUMP CART

Estimated Hourly Owning & Operating Cost

List Price	$3,500.00
Tires	$ 194.00
Price Less Tires	$3,306.00
Depreciation (15 year life)	12,600 Hrs.

Hourly Owning Cost

Dep.: $3,306.00 (Price Less Tires) ÷ 12,600 Dep. Hrs.	$ .262
Int., Ins., Taxes (.05/$100) x $3,500.00 List Price	= $ .175
Total	= $ .437

Hourly Operating Cost

Repairs: (10% Depreciation Per Hour)	= $ .026
Tires: $194.00 Replacement Cost ÷ 6,000 Hrs.	= $ .032
Total	= $ .058

Total Hourly Owning Cost	$ .437
Total Hourly Owning & Operating Cost	$ .495

A2000 SIDE DUMP TRAILER

Estimated Hourly Owning & Operating Cost

List Price	$7,000.00
Tires	$ 702.40
Price Less Tires	$6,297.60
Depreciation (15 year life)	12,600 Hrs.

Hourly Owning Cost

Dep.: $6,297.60 (Price Less Tires) ÷ 12,600 Dep. Hrs.	= $ .499
Int., Ins., Taxes (.05/$1000) x $7,000.00 List Price	= $ .350
Total	= $ .849

Hourly Operating Costs

Repairs: (10% Depreciation Per Hour)	= $ .050
Tires: $702.40 Replacement Cost ÷ 6,000 Dep. Hrs.	= $ .117
Total	= $ .167

Total Hourly Owning Cost	$ .849
Total Hourly Owning & Operating Cost	$1.016

SIDE DUMP HYDRAULIC DUMPER UNIT

Estimated Hourly Owning & Operating Cost

List Price	$4,500.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $4,500.00 (List Price) ÷ 10,080 Dep. Hrs.	= $ .447
Int., Ins., Taxes: (.05/$1000) x $4,500.00 List Price	= $ .225
Total	= $ .672

Hourly Operating Costs

Fuel: 5.6 kw hrs. x $.025/kw hr.	= $. 14
Hydraulic Oil: .03 gal. x $1.20/gal.	= $ .036
Filters	= $ .012
Repairs (60% Depreciation Per Hour)	= $ .268
Operator's wage	= $1. 50
Total	= $1.956

Total Hourly Owning Cost	$ .672
Total Hourly Owning & Operating Cost	$2.628

SIDE DUMP INCLINED FEEDER CONVEYOR

Estimated Hourly Owning and Operating Cost

List Price	$35,000.00
Depreciation (20 year life)	16,800 hrs.

Hourly Owning Cost

Dep.: $35,000.00 (List Price) ÷ 16,800 Dep. Hrs.	= $2.082
Int., Ins., Taxes: (.05/$1000) x $35,000.00 List Price	= $1.750
Total	= $3.832

Hourly Operating Costs

Fuel: 16.8 kw Hrs. x $.025 Per kw hr.	= $ .420
Repairs: (40% Depreciation Per Hour)	= $ .834
Operator's wage:	= $1.500
Total	= $2.754

Total Hourly Owning Cost	$3.832
Total Hourly Owning & Operating Cost	$6.586

SIDE DUMP UNLOADING RAMP

Estimated Hourly Owning Cost

List Price	$10,500.00
Depreciation (20 year life)	16,800 hrs.

Hourly Owning Costs

Dep.: $10,500.00 List Price ÷ 16,800 hrs.	= $ .625
Int., Ins., Taxes: (.05/$1,000) x $10,500.00 List Price	= $ .525
Total	= $1.150

CHAIN NET CART

Estimated Hourly Owning and Operating Cost

List Price	$1,050.00
Tires	$ 175.00
Price Less Tires	$ 875.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $875.00 Price Less Tires ÷ 10,080 Dep. Hrs.	= $ .087
Int., Ins., Taxes: (.05/$1000) x $1,050.00 List Price	= $ .053
Total	= $ .140

Hourly Operating Cost

Repairs: (25% Depreciation Per Hour)	= $ .022
Tires: $175.00 Replacement Cost ÷ 6,000 Hrs.	= $ .029
Total	= $ .051

Total Hourly Owning Cost	$ .140
Total Hourly Owning & Operating Cost	$ .191

CHAIN NET CANE TRAILER (2 COMPARTMENT)

Estimated Hourly Owning & Operating Cost

List Price	$5,500.00
Tires	$ 705.00
Price Less Tires	$4,795.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $4,795.00 Price Less Tires ÷ 10,080 Dep. Hrs.	= $ .476
Int., Ins., Taxes: (.05/$1000) x $5,500.00 List Price	= $ .275
Total	= $ .751

Hourly Operating Cost

Repairs: (25% Depreciation Per Hour)	= $ .119
Tires: $705.00 Replacement Cost ÷ 6,000 Hrs.	= $ .118
Total	= $ .237

Total Hourly Owning Cost	$ .751
Total Hourly Owning & Operating Cost	$ .988

HILO OR CHAIN NET DUMPER UNIT

Estimated Hourly Owning & Operating Cost

List Price	$14,000.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $14,000.00 (List Price) ÷ 10,080 Dep. Hrs.	= $1.390
Int., Ins., Taxes: (.05/$1000) x $14,000.00 List Price	= $ .600
Total	= $1.990

Hourly Operating Cost

Fuel: 16.75 kw hrs. x $.025/kw hr.	= $ .419
Repairs: (60% Depreciation Per Hour)	= $ .834
Operator's wage:	= $1. 50
Total	= $2.753

Total Hourly Owning Cost	$1.990
Total Hourly Owning & Operating Cost	$4.743

DIESEL TRACTOR (SCRAPPING)

Estimated Hourly Owning & Operating Cost

(Allis Chalmers D17 with Front End Loader or Equal)

List Price	$7,600.00
Tires	$ 265.00
Price Less Tires	$7,335.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $7,335.00 (Price Less Tires) ÷ 10,080 Dep. Hrs.	= $ .730
Int., Ins. Taxes: (.05/$1000) x $7,600.00 List Price	= $ .380
Total	= $1.110

Hourly Operating Cost

Fuel: 2.5 GPH x $.16 Per Gal.	= $ .400
Lube Oil - Engine: .025 GPH x $1.20 Per Gal.	= $ .030
Lube Oil - Transmission: .008 GPH x $1.20 Per Gal.	= $ .009
Hydraulic Oil: .015 GPH x $1.20 Per Gal.	= $ .018
Grease: .06 Lb/hr. x $.20 Per Lb.	= $ .012
Filters:	= $ .030
Repairs: (20% Depreciation Per Hour)	= $ .146
Tires: $265.00 Replacement Cost ÷ 6,000 Hrs.	= $ .044
Operator's wage:	= $ .950
Total	= $1.639

Total Hourly Owning Cost	$1.110
Total Hourly Owning Cost & Operating Cost	$2.749

CHAIN NET FEEDER CONVEYOR

Estimated Hourly Owning & Operating Cost

List Price	$25,000.00
Depreciation (20 year life)	16,800 hrs.

Hourly Owning Cost

Dep.: $25,000 (List Price) ÷ 16,800 Dep. Hrs.	= $1.487
Int., Ins., Taxes: (.05/$1000) x $25,000.00 List Price	= $1.250
Total	= $2.737

Hourly Operating Cost

Fuel: 11.2 kw Hrs. x $.025 Per kw Hr.	= $ .280
Repairs: (40% Depreciation Per Hour)	= $ .595
Operator's wage:	= $1.500
Total	= $2.375

Total Hourly Owning Cost	$2.737
Total Hourly Owning & Operating Cost	$5.112

BRIDGE CRANE

Estimated Hourly Owning & Operating Cost

List Price	$78,850.00
Depreciation (20 year life)	33,600 hrs.

Hourly Owning Cost

Dep.: $78,850.00 List Price ÷ 33,600 Dep. Hrs.	= $2.345
Int., Ins., Taxes: (.05/$1000) x $78,850.00 List Price	= $3.940
Total	= $6.285

Hourly Operating Costs

Fuel: 95 kw Hrs. x $.025 per kw Hr.	= $2.375
Lube Oil: .05 GPH x $1.20 per gal.	= $ .060
Grease: .1 Lb/Hr. x $.20 per lb.	= $ .020
Repairs: (40% Depreciation Per Hour)	= $ .939
Operator's Wages:	= $1.500
Total	= $4.894

Total Hourly Owning Cost	$6.285
Total Hourly Owning & Operating Cost	$11.179

220 FT. BRIDGE CRANE STRUCTURE

Estimated Hourly Owning Cost

Estimated Price	$45,000.00
Depreciation (20 year life)	33,600 hrs.

Hourly Owning Cost

Dep.: $45,000.00 Price ÷ 33,600 Dep. Hrs.	= $1.340
Int., Ins., Taxes: (.05/$1000) x $45,000.00 Price	= $2.250
Total	= $3.590

CONVENTIONAL FIELD CART

Estimated Hourly Owning & Operating Cost

List Price	$750.00
Tires	$175.00
Price Less Tires	$575.00
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $575.00 Price Less Tires ÷ 10,080 Dep. Hrs.	= $ .057
Int., Ins., Taxes (.05/$1000) x $750.00 List Price	= $ .038
Total	= $ .095

Hourly Operating Costs

Repairs: (20% Depreciation Per Hour)	= $ .011
Tires: $175.00 Replacement Cost ÷ 6000 Hrs.	= $ .029
Total	= $ .040

Total Hourly Owning Cost	$ .095
Total Hourly Owning & Operating Cost	$ .135

CONVENTIONAL SYSTEM CRANE (DRAGLINE)

Estimated Hourly Owning & Operating Cost

(1 yd. size)

List Price	$42,000.00
Depreciation (20 year life)	16,800 hrs.

Hourly Owning Cost

Dep.: $42,000.00 List Price ÷ 16,800 Dep. Hrs.	= $2.500
Int., Ins., Taxes: (.05/$1000) x $42,000.00 List Price	= $2.100
Total	= $4.600

Hourly Operating Cost

Fuel: 4.0 GPH x $.16 per gal.	= $ .640
Lube Oil-Engine: .04 Gph x $1.20 per gal.	= $ .048
Grease: .05 Lb./hr. x $.20 per lb.	= $ .010
Filters:	= $ .030
Repairs: (40% Depreciation Per Hour)	= $1.000
Operator's wage:	= $1.500
Sling Hooker's wage:	= $1.250
Sling Tripper's wage:	= $1.250
Total	= $5.728

Total Hourly Owning Cost	$4.600
Total Hourly Owning & Operating Cost	$10.328

CONVENTIONAL SYSTEM ROTATING DERRICK

Estimated Hourly Owning & Operating Cost

List Price	$90,000.00
Depreciation (20 year life)	33,600 hrs.

Hourly Owning Cost

Dep.: $90,000.00 List Price ÷ 33,600 Dep. Hrs.		= $2.675
Int., Ins., Taxes: (.05/$1000) x $90,000.00 List Price		= $4.500
	Total	= $7.175

Hourly Operating Cost

Fuel: 22.38 kw Hr. x $.025 kw Hr.		= $ .560
Lube Oil-Trans.: .015 x $1.20 per gal.		= $ .018
Grease: .05 Lb/Hr. X $.20 per lb.		= $ .010
Repairs: (40% Depreciation Per Hour)		= $1.070
Operator's wage:		= $1.500
	Total	= $3.158

Total Hourly Owning Cost	= $7.175
Total Hourly Owning & Operating Cost	= $10.333

CONVENTIONAL SYSTEM CANE SLINGS*

Estimated Hourly Owning Cost

List Price	$21,000.00
Depreciation (10 year life)	8,400 hrs.

Hourly Owning Cost

Dep.: $21,000.00 List Price ÷ 8,400 Dep. hrs.	= $2.500
Int., Ins., Taxes: (.05/$1000) x $21,000.00 List Price	= $1.050
Repairs: (20% Depreciation Per Hour)	= $ .500
Total	= $4.050

*Estimated sling requirements @ ½ sling per ton of daily unloading capacity, therefore, @ 3,500 tons/day capacity, 1750 slings are required. 1750 slings @ $12.00 ea. = $21,000.00.

CONVENTIONAL TANDEM AXLE CANE TRAILER

Estimated Hourly Owning & Operating Cost

List Price	$3,600.00
Tires	$ 702.40
Price Less Tires	$2,897.60
Depreciation (12 year life)	10,080 hrs.

Hourly Owning Cost

Dep.: $2,897.60 Price Less Tires ÷ 10,080 Dep. Hrs.	= $ .287
Int., Ins., Taxes: (.05/$1000) x $3,600.00 List Price	= $ .180
Total	= $ .467

Hourly Operating Cost

Repairs: (20% Depreciation Per Hour)	= $ .058
Tires: $702.40 Replacement Cost ÷ 6,000 Dep. Hrs.	= $ .117
Total	= $ .175

Total Hourly Owning Cost	$ .467
Total Owning & Operating Cost	$ .642

BANQUET ADDRESS

by
Warren J. Harang, Jr., President
ASSCT, 1964

For many years there had been a need for an organization which would bring together the men of Louisiana who had a new idea, or who had worked out a new or improved way of doing a job in such a manner that through work, skill, or management, an end may be reached which would bring with it profit to industry and satisfaction of accomplishment to the workers.

The Louisiana Sugar Cane Technologists Association was organized in April, 1938. At that time, a small group met at L.S.U. and organized themselves into a band of workers. Their efforts were dedicated to the advancement of the Louisiana sugar industry.

Officers: 1938 - 1939

W. G. Taggart - President
W. Dauhert - 1st Vice President
J. J. Munson - 2nd Vice President
Walter Godchaux, Jr. - Secretary-Treasurer

Officers: 1939 - 1940

J. J. Munson - President
M. V. Yarbrough - 1st Vice President
F. E. Farwell - 2nd Vice President
Walter Godchaux, Jr. - Secretary-Treasurer

During the war years, activities of our Society were necessarily limited in scope by restrictions on travel, the urgent demands of other duties on the time of the officers and members, and the entrance of others into the armed forces. Meetings were reduced in number, and in 1943, 1944, and 1945, instead of regular meetings, all of the sections met together in one annual meeting. How the society has carried on, and through committee reports, papers, abstracts and other information distributed to members has endeavored to render the best possible service under existing conditions.

In 1945, in recognition of the increasing membership in other states and of the material scope of the aims of the organization, the name was changed from the Louisiana Sugar Cane Technologists Association to the American Society of Sugar Cane Technologists.

Officers: 1945

George Arceneaux - President
E. C. Simon - 1st Vice President
A. J. Isacks - 2nd Vice President
F. A. Vought - Secretary-Treasurer

On July 22, 1963, the American Society of Sugar Cane Technologists was amended.

Five Classes of Members

Active - $3.50 - Engaged in production
Associate - $10.00 - Not actively engaged in production
Supporting - $20.00 - Individual & manufacturers producing cane for sugar
Honorary - None - An individual who has distinguished himself
Foreign - $5.00

The same method of electing its officers has not changed. There was then a nominating committee.

There should be two sections

1. Manufacturing
2. Agricultural

Officers: 1964

Warren Harang, Jr. - President
W. S. Chadwick - 1st Vice President
Paul Cancienne - 2nd Vice President
Denver T. Loupe - Secretary-Treasurer

Amendments to this constitution may be made only at the annual meeting or a general meeting of the Society. Written notices must be proposed in writing, accompanied by the signature of at least (20) active members. This must be given to the Secretary-Treasurer at least (20) days before the date of the meeting and he must notify each member of the proposed amendment before the date of the meeting. All amendments shall be adopted by a 2/3 majority of those voting. These are the functions of your organization.

I am forever grateful to each one of you for your support this past year.

MINUTES, ANNUAL MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

FEBRUARY 4, 1965

The Annual Meeting of the American Society of Sugar Cane Technologists was held at Pleasant Hall, L.S.U. Campus, Baton Rouge, Louisiana, Thursday, February 4, 1965.

The meeting was called to order by President Warren Harang, Jr. at 9:55 A.M. Several announcements were made at this time. Such items as: the time of the business session, banquet, and also a moment of silent prayer in memory of Mr. Donald Draughn, Editor of the Sugar Journal who had passed away the night before on February 3, 1965.

Promptly at 10:00 A.M., the President presented the Chairman of the Agricultural Section, Mr. E. R. Stamper, who in turn presided during the presentation of the program. Interesting papers, comments and discussions were presented by a panel of individuals on the subject, "General Field and Harvest Conditions in 1964 and A Look at Cultural Practices and Mosaic Control Measures in 1965".

Participants were:

1. Douglas Stevens, Cinclare Central Factory
2. Minus Granger, County Agent, St. Mary Parish
3. Calvin Burleigh, Southdowns, Inc.
4. Ramon Billeaud, Billeaud Sugar Factory
5. E. J. Lousteau, County Agent, Assumption Parish

Following the Agricultural Section Program, a business session was called to order by Mr. Harang. Among the items presented were:

1. Financial statement distributed by the Secretary-Treasurer. Approved as distributed.
2. Report from Constitution and By-laws Committee by Mr. Pat Cancienne. No changes recommended, but an up-to-date copy of the Constitution and By-laws was distributed to the group.

3. Discussion of plans for travel and reservation arrangements to the I.S.S.C.T. Comments about local arrangements with a travel agency were made by Dr. S. J. P. Chilton.

4. Certificates to Supporting Members were presented. (Names were read at meeting, certificates will be mailed).

5. Richard "Dick" Gibbens proposed the name of Dr. E. V. Abbott, Superintendent and Plant Pathologist at the U.S.D.A. Sugar Cane Station at Houma, Louisiana, for Honorary Membership. The name was seconded by Mr. Horace Nelson and unanimously approved.

The meeting was adjourned for lunch at 12:00 Noon and at 2:00 P.M. the meeting reconvened.

President Harang introduced Thomas Allen, Chairman of the Manufacturing Section who in turn presented the following program:

1. Performance of Gatke Molded Fabric Bearings on Sugar Mill Journals and Auxiliary Equipment, by Norman Radloff, but presented by A. W. Norman, New Iberia, Louisiana.

2. Application of Stearns Magnetic Separators in Sugar Cane Milling, by W. J. Bronkala, Indiana General Corporation.

3. Some Ideas and Remarks about Evaporation by Carlos M. Alonzo, Duhe & Bourgeois Sugar Company.

This session was adjourned until time for the Banquet.

The Banquet got underway at 6:30 P.M. with 160 members attending. Invocation was given by Mr. Frank Barker, Jr. After the meal, a brief program was presented. President Harang called to the attention of the membership that several other members; namely, Frank Vaught, H. J. Miller, and Thomas Lowe had passed away during 1964. A moment of silent prayer was observed to their memories.

President Harang presented the out-going officers, thanking them for their efforts in making his term as President a successful one. Past Presidents who were seated at a special table were also recognized.

The announced Guest Speaker, Mr. Dave Pearce, Commissioner of Agriculture, was ill and could not attend the Banquet. Mr. Harang spoke briefly about

our Society, citing its origin, changes and developments that have occurred and challenged the in-coming officers to lead the membership into the development of an even greater organization.

The 1965 officers were introduced and are as follows:

President - W. S. Chadwick
1st Vice President - Paul Cancienne
2nd Vice President - Thomas Allen
Chairman, Ag. Section - Kermit Coulon
Chairman, Mfg. Section - Irving Legendre, Jr.
Chairman at Large - Warren Harang, Jr.
Secretary-Treasurer - Denver T. Loupe

Mr. W. S. Chadwick accepted the chair from Mr. Harang, asking each member of the Society to "let us know the ideas you have as to how we can improve". On behalf of the Society, he thanked the out-going officers for "a job well done". The meeting adjourned at 7:45 P.M.

Respectively submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

MINUTES OF THE SUMMER MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

JUNE 3, 1965

The Summer Meeting of the American Society of Sugar Cane Technologists was held on Thursday, June 3, 1965, at Francis T. Nicholls State College, Thibodaux, Louisiana.

The meeting was called to order by President W. S. Chadwick. He acknowledged the splendid attendance, recognized those responsible for arrangements, and called on Dr. Jack Stanley for the welcome. Dr. Stanley expressed regrets that Dr. Vernon Galiano, President of the College for being unable to attend, but did welcome the Society in his behalf and reaffirmed their vital interest in the sugar cane industry.

President Chadwick then presented Kermit Coulon, County Agent, St. James Parish and Chairman of the Agricultural Committee who in turn presented the following program:

Twelfth Congress - I.S.S.C.T. 1965, A Report	Denver T. Loupe Specialist (Agronomy) LSU, Cooperative Extension Service Baton Rouge, Louisiana
A Report on Sugar Cane in Puerto Rico	Lloyd L. Lauden, Agronomist American Sugar Cane League New Orleans, Louisiana
Some Research Papers Related to Louisiana Problems Presented at the 12th Congress - I.S.S.C.T.	R. D. Breaux, Research Agronomist, Crops Research Div. U.S.D.A. Sugar Cane Field Stat. Houma, Louisiana
The Use of Chemical Herbicides in the Culture of Sugar Cane for Sugar Production in Louisiana	Ernest R. Stamper, Assoc. Prof. Department of Botany & Plant Pathology, LSU Agricultural Experiment Station Baton Rouge, Louisiana

After a short coffee break, the group reassembled for a brief business session. Items of business considered were the approval of the Society to extend an invitation to the Florida Sugar Industry to join the A.S.S.C.T., and a motion authorizing the Secretary-Treasurer to draft a letter of commendation to Dr. C. W. Edgerton for his nomination to Life Membership of the I.S.S.C.T.

Following this brief business session, President Chadwick presented Mr. Irving Legendre, Jr., Chairman of the Manufacturing Section for their program which was as follows:

Moving Cane Storage Away from the Mill - Is It Feasible?	Harold A. Willet Cameco Thibodaux, Louisiana
Inclined Feeder Table and Dumping System at the Raceland Factory	J. L. Mathews, Manager Raceland Factory Raceland, Louisiana
Cane Handling at Cajun Sugar Cooperative, Inc.	Luis A. Suarez, Plant Manager Cajun Sugar Cooperative, Inc. New Iberia, Louisiana
The Side Dump System of Sugar Cane Handling	Larry L. Fowler J & L Engineering Co., Inc. Jeanerette, Louisiana

The program being completed, the group adjourned to the American Legion Building for lunch.

Respectively submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

CONSTITUTION OF THE

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS
(As amended July 22, 1963)

ARTICLE I

Name and Object

Section 1. The name of this Society shall be the American Society of Sugar Cane Technologists.

Section 2. The object of this Society shall be the general study of the sugar industry in all its various branches and the dissemination of information to the members of the organization through meetings and publications.

ARTICLE II

Membership

Section 1. There shall be five classes of members: Active, Associate, Supporting, Honorary and Foreign.

Section 2. Active members shall be individuals actually engaged in the production of cane or the manufacture of sugar, or research pertaining to the industry.

Section 3. Associate members shall be individuals not actively engaged in the production of sugar, but who may be interested in the objects of the Society.

Section 4. Supporting members shall be individuals manufacturing and their agents engaged in the production of cane or sugar, or distribution of equipment or supplies used in conjunction with production of cane or sugar, who may be interested in the objects of the Society.

Section 5. Honorary membership shall be conferred on any individual who has distinguished himself in the sugar industry, by being proposed at the

annual meeting and elected by a majority of those voting. Honorary members shall be exempt from dues and entitled to all the privileges of active membership.

Section 6. Applicants for membership shall make written application to the Secretary-Treasurer endorsed by two active members, such applications shall be acted upon by the membership committee.

Section 7. Annual dues shall be as follows:

Supporting Membership-------	$20.00
Associate Membership--------	$10.00
Foreign Membership----------	$ 5.00
Active Membership-----------	$ 3.50
Honorary Membership---------	NONE

Dues shall be paid by January 1st of each year. New members shall pay the full amount, irrespective of when they may join.

Section 8. Members in arrears for dues for more than a year will be dropped from membership after thirty days notice to this effect from the Secretary-Treasurer. Members thus dropped may be reinstated only after payment of back dues and assessments.

Section 9. Only active members of the Society shall have the privilege of voting, holding office and initiating discussion from the floor at general meetings.

ARTICLE III

Officers

Section 1. The officers of the Society shall be: a President, a First Vice-President, a Second Vice-President, a Secretary-Treasurer, and an Executive Committee of these and three others, one from each Section (as described in Article V) of the Society and one elected at large.

As decided by a majority vote of members present at the June 4, 1959, meeting, the Constitution has been amended as follows:

Article III, Section 1. The following sentence shall be added to this section:

"The Ex-President shall serve as an Ex-Officio member of the Executive Committee for one year following his term of office."

Section 2. These shall be nominated by a nominating committee and voted upon before the annual meeting. Notices of such nominations shall be mailed to each member at least one month before such meeting. Ballots not received before noon of the Saturday preceding the first day of the meeting will not be counted.

Section 3. The duties of these officers shall be such as usually pertain to such officers in similar societies.

Section 4. Each section as described in Article V shall be represented in the offices of the President and Vice-Presidents.

Section 5. The officers of the Society shall hold office for one year only, or until their successors shall be elected.

Section 6. The President of the Society shall not hold office for more than one consecutive year.

Section 7. The President shall be elected each year consecutively from each of the sections.

Section 8. Vacancies occurring between meetings shall be filled by the Executive Committee.

Section 9. The terms "year" and "consecutive year" as used in Articles III and IV shall be considered to be comprised of the elapsed time between one annual meeting of the Society and the following annual meeting of the Society.

ARTICLE IV

Committees

Section 1. The President shall appoint a committee of three to serve

as a Membership Committee. It will be the duty of this committee to pass upon applications for membership and report to the Secretary-Treasurer.

Section 2. The President shall appoint each year a committee of three to serve as Nominating Committee. It will be the duty of the Secretary of the Society to notify all active members as to the personnel of this committee. It will be the duty of this committee to receive nominations and to prepare a list of nominees and mail this to each member at least a month before the annual meeting.

ARTICLE V

Sections

Section 1. There shall be two sections, to be designated as:

1. Manufacturing
2. Agricultural

Section 2. The Manufacturing Section will include all members primarily interested in factory problems.

Section 3. The Agricultural Section will include all members primarily interested in agricultural problems.

Section 4. Members may be enrolled in one or both sections, as their interests or inclinations dictate.

Section 5. There shall be a Chairman for each section who will be the member from that section elected to the Executive Committee. It will be the duty of the Chairman of a section to prepare reports for the annual meeting, and he will appoint his own sub-chairman to handle the individual topics.

Section 6. The Executive Committee is empowered to elect one of their own number or to appoint another person to handle the details of printing, proof reading etc., in connection with these reports and to authorize the Treasurer to make whatever payments, may be necessary for same.

ARTICLE VI

Section 1. The annual meeting shall be held in February of each year, at such time as the Executive Committee shall decide.

Section 2. Special meetings of a section for the discussion of matters of particular interest to that section may be called by the President upon request from the respective Chairman of a section.

Section 3. At the annual meeting, ten percent of the active members and the President or a Vice-President shall constitute a quorum.

ARTICLE VII

Management

Section 1. The whole management of the affairs of the Society, including the direction of work of special committees, shall be in the hands of the Executive Committee.

Section 2. The Executive Committee shall represent this Society in conferences with the American Sugar Cane League or any other association, and may make any rules or conduct any business not in conflict with this Constitution.

Section 3. Four members of the Executive Committee shall constitute a quorum, the President, or in his absence one of the Vice-Presidents, shall be Chairman of this committee.

Section 4. The Executive Committee shall make a report to the Society at the annual meeting.

Section 5. At the annual meeting, the President shall appoint the members of the regular committees, and such other committees as may be suggested.

ARTICLE VIII

Amendments

Section 1. Amendments to this Constitution may be made only at the annual

meeting or at a general meeting of the Society. Written notices of such proposed amendements, accompanied by the signature of at least twenty (20) active members must be given to the Secretary-Treasurer at least thirty (30) days befor the date of the meeting, and he must notify each member of the proposed amendment before the date of the meeting.

Section 2. Amendments shall be adopted by a two thirds majority of those voting.

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 13 - Papers for 1966

December, 1966

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 13 - Papers for 1966

December, 1966

FOREWARD

This is the thirteenth volume of proceedings of the Society which has been published since its founding in 1938.

The first volume, published in 1941, included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume, published in 1946, included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer, edited that edition.

The third volume, published in 1953, included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years of 1950 through 1953. Volume five contains papers for the years of 1954 and 1955. The sixth volume included papers presented during 1956. The third through the sixth volumes were edited by Dr. Arthur G. Keller.

The Seventh volume, which is in two parts, 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth through the twelfth volumes contain papers presented during 1961 through 1965, respectively. These volumes, as well as this, the thirteenth volume, which includes papers for the year 1966, have been compiled by the writer.

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

December, 1966

INDEX

General PAGE

NEW CONCEPT FOR MAIN CANE CARRIER DRIVES

Robert P. Harper, Jr. & William H. Johnston
F. N. Johnston Company, New Orleans, Louisiana

Preface

Main carrier drives in Louisiana sugar mills are, and have been, predominately reciprocating steam engines. Due to increased mill grinding rates and natural attrition, a need has risen for a modern replacement for these engines which will do the job and at the same time lend itself to controls for automatic mill feeding. The 1965 grinding season saw the installation of the first Eddy-Current Coupling Drive in a Louisiana mill. This drive appears to be a satisfactory drive for this application because it meets these three criteria:

1) High reliability
2) Simple, standard, off-the-shelf components
3) Readily adaptable for automatic operation

Background

In the spring of 1965 Mr. P. A. Kerne of the Iberia Sugar Co-op purchased one of these drives for his main carrier. The Voorhies Supply Company, a distributor for Reliance Electric and Engineering Company, sold this drive to Mr. Kerne as a replacement for a wound rotor motor which had driven the main carrier, but which did not have sufficient horsepower for the increased volume of cane which Iberia was grinding. After discussing the application with Mr. Kerne a 60 hp. Reliance V*S water-cooled coupling was recommended with a speed range of 1700 to 100 rpm. The drive arrangement which was installed is shown in Figure 1.

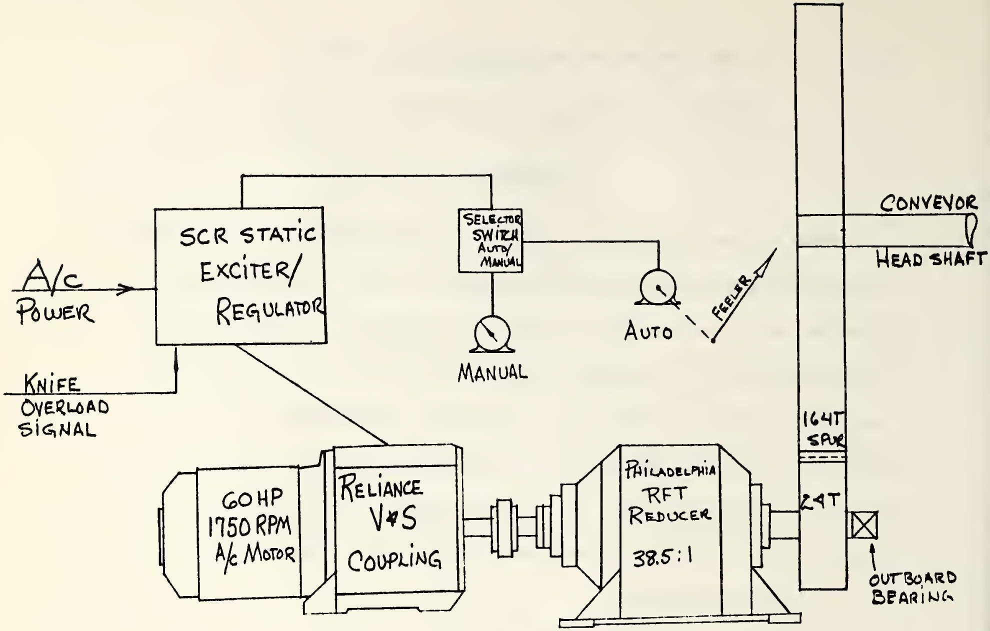


FIGURE 1

COUPLING DESCRIPTION

The Eddy-Current coupling consists of three basic components:

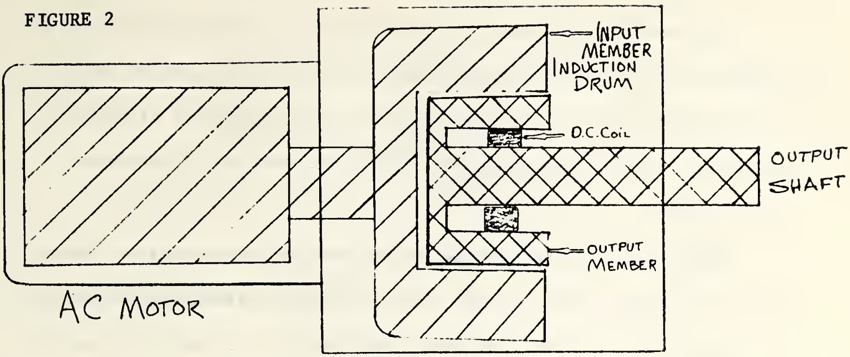
1) The inductor drum which is mounted on the shaft of the constant speed standard A-c. squirrel cage motor.

2) The stationary D-c. coil which controls the coupling field strength.

3) The pole piece assembly which constitutes the variable speed output member.

Figure 2 shows the arrangement of these three components.

FIGURE 2



Torque is transmitted from the inductor drum to the pole piece assembly by means of Eddy-Currents. Variable output speed results from controlling the level of the field excitation of the stationary direct current coil which is mounted within the output member pole piece.

In operation a power supply voltage is selected as a reference by the operator's speed setting potentiometer. The output member of the coupling matches the speed set by the potentiometer and if this speed should vary with load, a built-in tachometer on the output shaft senses the variation from the set speed. This signal automatically changes the power supply voltage to the D-c. coil to bring the speed up or down to the pre-set speed. In effect what you now have is an output shaft which maintains the set speed within a range of 1%. This we think you'll agree is as good, or better, than you will ever need in the application of driving a main carrier.

Speed Controls

The standard coupling is provided with a control station which contains a speed setting potentiometer marked in increments from 0 to 100% and a start and stop push button. This control station is connected to the control cabinet which controls the Eddy-Current coupling coil.

This control station would be all that is required for a manually operated coupling, which would provide the equivalent of the manually controlled steam engine. However, the need is for automatic feeding of the mill so two overriding controls are desirable.

1) A device to stop the main carrier if the knife becomes overloaded.

2) A means of measuring volume and density of cane to provide uniform feed to the crusher or first mill.

Referring back to Figure 1, you will note that we had an override for the knife. On each knife there is a centrifugal switch, driven by means of a belt drive. These switches are connected into the control circuitry of the Eddy-Current coupling so that the main carrier will automatically stop whenever the knives slow down below a given speed level. When the turbine regains its speed the coupling automatically starts. Mr. Kerne reports that during the 1965 grinding season only one choke occurred at the knives and this was due to a problem external to the switches and the coupling drive.

FIGURE 3

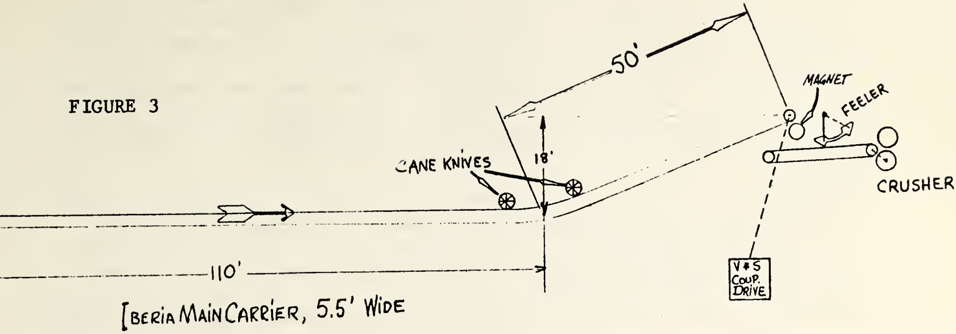


Figure 3 shows the general schematic of the main carrier and feeder conveyor at Iberia Co-op. The feeler device for measuring the volume into the crusher was located near the crusher on the feeder conveyor.

Again referring to Figure 1 you will note that a selector switch was included to allow the mill to switch from automatic to manual control.

Both the manual rheostat and the rheostat connected to the feeler device are linear in nature. That is, at 100% you have full speed which in this case was 42 ft/min, 50% setting half speed, 15% setting 6 ft/min. etc. For normal mill grinding the rheostat position

was 50% to 60%. This provides a very desirable feature. We all know of numerous reasons why you will occasionally get a low volume of cane on the carrier. With the drive geared in as we have, the drive has the ability to nearly double the speed of the carrier when it is required to catch up.

This ability to accelerate rapidly was an advantage we did not realize until operation began. This drive could accelerate the conveyor from rest to full speed in two seconds with an absolute smooth application of power so that no shock was imparted to the gears or chain.

The deceleration time was also a surprise to us, but contrary to the acceleration time, this proved to be a problem. From full speed to rest took approximately 7 seconds. We have since determined that by going to a 1200 rpm A-c. motor, we can reduce the deceleration time from 7 seconds to 2 seconds. This means that with the conveyor normally operating at half speed we will be able to decelerate from normal operating speed to zero in 1 second.

Because of this experience we have learned a valuable lesson on the importance of acceleration and deceleration. We now know how to provide a drive with a rapid rate of response. This is very important for automatic operation.

Automatic Controls

After close observation through much of the grinding season we have come to the conclusion that the feeler device is very limited in its accuracy. It does not give a measure of cane density since you are merely measuring the depth of the mat.

For the past several months we have studied this problem and feel that we have the answer to an accurate means of measuring cane density and volume. We propose to use a current signal from the motor driving the kicker, which is located at the end of the main carrier at the Iberia Co-op. With this type of control it would be possible to set a current signal equivalent to load, so that when the current to the drive motor of the kicker increases the V*S coupling would automatically slow down. If the loading should go down, the coupling speed would increase in an attempt to maintain full load on the kicker.

The current regulated type of speed control is one which Reliance has utilized for many years for various feeder applications. We believe that this will be the ideal solution for automatic control of the sugar mill main carrier drives, since the load on the kicker motor is a true indication of the density of the mat of cane.

Summation

If a manual control is all that is desired, our basic coupling control will work in any sugar house. If an automatic feed system is desired, a great many variables might affect the type of control device that is utilized. Such things as the main carrier arrangement, kicker location, location of the shredder, knife location, feeder conveyors, and so forth, are variables which must be considered in selecting the type and location of automatic controls for the coupling.

Because of its simplicity, and the ease with which automatic signals can be employed, we believe that in the near future it will be possible to automate the feeder tables, and main carrier and provide

uniform loading on the knives, and uniform feed to the mills.

After an experience of one grinding season we are satisfied that the Eddy-Current coupling is suitable as a main carrier drive. The limitations that we have mentioned can be overcome. The fact that 225,000 tons of cane were handled by this coupling in the 1965 grinding season, with a maximum rate of 4900 tons in one day, would indicate that this is a machine which is rugged enough and versatile enough to work in a sugar house.

A PROGRESS REPORT ON THE FILTRATION OF RAW AND LIMED CANE JUICE USING THE HAYWARD FILTER

J. M. Kinabrew, Jr.
Standard Supply and Hardware Co., New Orleans, La.

Extraction, Clarification, Evaporation, Crystallization -- these four sum up, to a large degree, the manufacturing side of sugar cane technology.

Over the years, progress has been made in all four steps, but any mill owner, engineer, or fabrication superintendent will agree that there is still much to be done -- particularly -- by improving clarification.

A study of prior work in the field shows that most of the work has been done to improve raw juice clarifiers that are basically settling tanks, to devise better methods of recovering additional sucrose from the mud from these clarifiers, and to further clarify the juice from the clarifiers and the filtrate from the mud filters.

When we took on the sale of the Hayward Filter in this area, we selected the raw sugar industry as one of the prime prospects. Then we listed the possible applications of the filter in a raw sugar mill.

If "Fools rush in where angels fear to tread," than I guess we are pretty foolish, for we selected raw juice as the one spot where we felt that the Hayward Filter could -- and we hoped would -- make the greatest contribution to improved mill practice.

Now a word about the Hayward Filter. It is a pressure type filter that has some resemblance, in appearance, to an evaporator.

The filter media are perforated stainless steel tubes wound with fine stainless steel wire.

The tubes have a flanged top and are set into a tube sheet with an

o-ring seal. The lower end of the tube has a nipple that goes into a manifold, sealed with another o-ring.

Flow is into the space below the tube sheet surrounding the tubes, through the tubes, and out through the manifold. Clear filtrate also rises into the upper chamber, above the tube sheet, and can be observed by means of a sight glass.

The cake builds up on the outside of the tubes. When it reaches a predetermined thickness, the juice flow is cut off and the unfiltered juice remaining in the filter is blown by air pressure into the blowback line and the juice in the cake is blown into the clear juice outlet.

A minimum amount (one-half gallon per square foot of filter area) of water is fed in and the cake sweetened off. Air is then introduced and the remaining liquid is blown from the cake.

Water is then run into the top chamber and, when it is full, the dump valve on the bottom of the filter is opened. The water backflushes through the tubes from inside out and the spent cake is washed away in the form of slurry.

All of this can be done automatically by use of a control panel and air or electrically operated valves. The control panel has a variable time dial for each step in the cycle and can be set to conform to conditions as they exist at any particular time or mill.

Any of the steps can be bypassed by simply setting the time dial for that step to zero and the filter will bypass it.

As many or as few steps can be programmed as required when the unit is installed and additional steps added later by installing additional time dials and the valves they control.

In anticipation of the 1964 campaign, we made arrangements with Dr. John Seip to conduct some experiments at the Audubon Factory at L.S.U. with two of our personnel -- C. J. Bernard and Ed Hahn. Dr. Seip's cooperation and advice were invaluable, as was the advice and filter aids furnished by Antoine Alciatoire of the Dicalite Company.

With a one-half square foot filter area back flush test filter, we ran tests on hot unlimed raw juice, hot limed raw juice, hot clarifier mud, and hot evaporator syrup (60° Brix). These materials were filtered at various temperatures and with various combinations of precoat and body feed (or none at all).

What we learned in 1964 was all negative. We found that we could not filter clarifier muds without diluting them to the approximate density of raw juice, and we learned that hot syrups had special problems connected with them.

Then we came back to our original "foolish" idea -- that a really good clarification system would remove the unwanted substances from the juice early in the process and do away with the necessity of further clarification of the liquid at any later stage, as well as minimize the deposition of scale in heaters, evaporators, and pans.

So we tested the filter on juice. Again results were negative -- but only relatively so. The filter actually did a good job of cleaning up the juice, but the cycle was so short as to make the process uneconomical.

The trouble was that the cake compacted quickly and the flow rate quickly dropped off to an unacceptable figure. This was diagnosed as being too high an input pressure at the filter.

During the off season we worked out a system of regulating the input pressure without cutting the flow rate and made arrangements with Frank Barker to run some tests at Valentine during the 1965 campaign.

After the start of grinding, we set up the one-half square foot test filter and began to test it on cold raw juice -- both limed and unlimed.

The results were immediately promising. We got good flow rates and produced a good juice, apparently suitable to be heated and fed direct to the evaporator. The question now was, "It's a pretty juice, but will it make good sugar?"

Valentine has a small vacuum pan which they built for experimental work some years ago. Frank Barker allowed us to hook it up and we had the factory send us a twenty-five square foot back flush filter so that we could run some larger scale tests and secure enough juice to cook down and make some sugar.

Tests with the larger filter proved promising and helped us to establish precoat and bodyfeed rates and techniques, time cycles, and flow rates.

The test period included good weather (before December 13) and wet weather (after December 13). We were therefore able to determine what changes in body feed rates and filter cycles would be necessary under varying conditions.

At one time the mill was down and we could not get any raw juice, so we utilized the time to run tests on juice from the mill's clarifiers. These results were also excellent, the improvement in the quality of juice being considerable.

Tests were also run on juice from the rotary vacuum filters. This

was still full of suspended solids and plugged the filter at once.

Enough clarified juice (from cold limed raw juice) was run to make two strikes. Both the syrup (meladura) and massecuite were tested and proved to have high purity and low ash content.

Results of the various tests are summarized in the attached tables.

We believe that the Hayward Filter can be used to clarify cold raw juice, limed or unlimed, quickly and produce a clarified juice suitable for heating and feeding to the evaporator without further treatment. If the sweetening off step is included, it also produces a quantity of sweet water which can be used as maceration water or blended with the clarified juice going to the evaporators.

Since the airblown cake tested 2.5% to 3.3% sucrose without sweetening off, we feel that this sweetening off step can well be dispensed with.

All this can be done automatically, the only labor being that necessary to keep the precoat and body feed slurry tanks full, plus superintendence of the controls by the fabrication superintendent.

The advantages are, we believe, obvious.

(1) Raw juice is filtered and is ready for the evaporators in minutes instead of hours. This speed will go a long way in controlling pH and inversion losses.

(2) Since this is a quick and continuous process, pH can be accurately controlled. A pH meter can be placed in the filtered juice output stream and arranged to control the automatic addition of a lime slurry to the raw juice input stream ahead of the filter. Therefore, only enough lime need be added to adjust the pH at the moment. You won't

have to guess what the pH will be after the juice has been in a clarifier for four or more hours, and add possibly more lime than needed.

(3) Since the juice produced is so clean and without excess lime, it will cut down on scaling in juice heaters, evaporators, and pans, and on ash in the finished sugar.

(4) The system will eliminate the clarifiers and rotary vacuum filters. This will reduce invested capital, cut labor costs, and reduce maintenance costs.

(5) The pH of filtered juice from unlimed raw juice ran from 4.3 to 5.5, that of filtered juice from limed raw juice ran from 6.5 to 6.9. The flow rate of unlimed juice was twice that of limed juice.

We did not have time to run enough juice from unlimed juice to cook down and make a strike. It is possible that unlimed juice might make a good sugar -- if so, we could dispense with the liming station entirely.

If the Hayward Filter can produce a good quality of juice, at any acceptable rate of flow, and with the above advantages, what is holding up immediate use of the system?

First, we have to get the cost of operating the system down. The equipment cost, amortized over a ten year period is very modest. The cost of filter aids -- precoat and body feed -- are higher than can be justified.

We feel that continued experiments will result in our finding less expensive precoat materials and possibly, ways to reduce the amount of body feed required.

Second, we hope to arrange for further tests this year in Florida or Puerto Rico. The ideal setup would be to install a Hayward Filter in parallel with a conventional clarifier system in a mill with two sets of heaters and evaporators.

Runs could then be made on both unlimed and limed juice, with various types and amounts of precoat and body feed.

Tests of the raw juice, clarified juice, filtered juice, syrup from clarified juice, and syrup from filtered juice would be made. Comparisons of Brix, sucrose, purity, pH, glucose, and ash could be made between the products of the two systems and we would then have a more definite picture of the advantages we believe that the Hayward Filter system has.

In closing, we would like to acknowledge the cooperation, help and advice of the following people, without whom there would have been no report to make:

Dr. John Seip, L.S.U.
Frank Barker)
Al Gissing   ) Valentine
Edmond Becnel)
Connie Melancon, South Coast
J. F. White, Jr., Georgia Refinery
Evans Farwell, Milliken & Farwell
Antoine Alciatoire, Dicalite

And last but not least, the two fellows who did all the work, which I simply report:

C. J. Bernard
Ed Hahn

RAW COLD JUICE, LIMED

TEST	BRIX	SUCROSE	PURITY	PH	CAKE SUCROSE	REMARKS
11/12/65/9	10.15	7.94	78.23			Water used as precoat medium
11/12/65/10	11.62	9.31	80.12	6.8		Filtered juice used as P.C. medium
11/12/65/11	11.72	9.18	78.33	6.8		Do
11/12/65/12	12.12	9.44	77.89	6.5		Do
12/11/65/13	10.31	8.18	75.67		3.30	Water used as precoat medium
12/21/65/33	9.20	7.36	80.00			Filtered juice used as P.C. medium

RAW COLD JUICE, LIMED

	BRIX	SUCROSE	PURITY	GLUCOSE	REDUCING SUGAR RATIO	POL	INVERT	MOISTURE	ASH	PH
Raw Juice	15.50	7.91	81.03							
Do, Refracted	10.06	8.05	80.02							
, Settled	14.20									
Filtered Juice	9.20	7.36	80.00							
Syrup, 28° Baume'	49.40	40.00	80.97							
Massecuite	93.00	77.00	82.80	4.575	16.80				5.439	
Raw Sugar						95.75	1.25	1.041	.761	

RAW COLD JUICE, UNLIMED

	BRIX	SUCROSE	PURITY	GLUCOSE	REDUCING SUGAR RATIO	ASH	PH
Filtered Juice	9.90	7.81	78.89	.704	9.02	.858	5.5
Syrup, 28° Baume'	57.70	46.60	80.76	4.167	8.95	4.835	5.2

ADDENDUM

A PROGRESS REPORT ON THE FILTRATION OF RAW AND LIMED CANE JUICE, USING THE HAYWARD FILTER

J. M. Kinabrew, Jr.
Standard Supply & Hardware Co., Inc.

When this paper was written, we had not yet been to Florida; but since then we ran 23 tests with a laboratory size filter at the U.S. Sugar Corporation at Clewiston, Florida.

Our results did not duplicate those achieved in Louisiana this season, nor did we expect them to do so. Here is a summary.

Cold Mixed Juice.

PH was not affected by filtering -- 5.40 to 5.45 before, 5.45 to 5.5 after. Brix (by refractometer) 14.0 before, 14.2 after. Sucrose increased slightly, 12.34 to 12.73. Purity improved, 88.14 to 89.65. Clarity was not measured -- it was not good as we expected (about equal to the product of their clarifiers at the same time) and when boiled down to syrup showed considerable precipitate.

We did not produce a clear filtrate from cold mixed juice as we had done in Louisiana. Possible reasons are -- different cane, soil, and harvesting methods, or different test conditions (our pump for these tests had a shut-off head of 20 psi and we had to use a different precoat filter aid).

As of the moment we can only say that the possibility of achieving acceptable clarification in one step is worthy of further investigation.

Cold Limed Juice.

PH decreased in filtering, probably because we filtered out some lime -- 7.85 to 8.1 before, 7.5 to 7.60 after. Brix (by refractometer) 13.0 before, 13.2 after, (by spindle) 13.45 before, 13.70 after. Sucrose increased 11.33 to 11.69 before, 11.71 to 11.82 after. Purity improved in one test, 84.24 before, 85.47 after, and went down in another, 89.92 before, 89.55 after. Clarity was excellent, much better than the product of your clarifiers, by inspection. Some filtrate was boiled down to syrup.

Results here paralleled our results in Louisiana. We cannot offer a reason why cold limed juice filters equally as well, but cold mixed juice does not.

We believe that further testing on a larger scale -- say at a rate equal to 10% of cold limed juice output -- paralleling present clarification and extending through the evaporation state, will result in the establishing of filtering techniques, proper types and amounts of filter aids, and proper handling of filter cake to replace clarifiers and rotary vacuum filters.

Rotary Vacuum Filter Juice.

PH was not checked. Brix (by spindle) 8.38 before, 8.75 after. Sucrose increased slightly, 7.09 before, 7.27 after. Purity decreased, 84.61 before, 83.08 after. Clarity was much improved (by inspection) and apparently could go right to the evaporators instead of back to a previous stage in the process.

We feel that a Hayward Filter would do a fine job right now in this stage. The only further testing required would be to

establish minimum precoat and body feed quantities and the length of filter cycles under varying conditions of mud.

So much for the tests and the conclusions that we have reached so far.

You will agree with us, I am sure, that the better clarification you achieve, the better your end product will be.

Also, the more you can reduce the time juice is retained in the process, the less inversion will take place and the more sugar you will produce per ton of cane.

And last, but not least, if you remove the impurities early and reduce the amount of lime required, you will certainly cut down on your operating and maintenance costs -- less wear on pumps, valves, etc., less scaling of heaters and evaporators.

SOME EFFECTS OF HURRICANE BETSY ON CANE YIELDS IN 1965

L. G. Davidson and J. E. Irvine, Research Agronomist and Research Plant Physiologist, respectively, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, U. S. Sugarcane Field Station, Houma, La.

Hurricane Betsy was the most destructive storm to strike southeastern Louisiana in the twentieth century. The eye of this fast-moving storm crossed the coast near the Jefferson-Lafourche Parish line and proceeded northwest, passing over Houma, Louisiana, between midnight and 1:00 A.M. on September 10. Gusts in excess of 130 miles per hour were estimated at Houma both before and after passage of the eye. The storm gradually weakened as it proceeded inland; Baton Rouge recorded a peak gust of 92 miles per hour.[1/]

Sugarcane at the Houma Station was severely lodged by the storm (Fig. 1, 2) but there was little breakage of the important commercial varieties. Following the storm the cane recovered rapidly, and within 1 week the lodging was much less apparent (Fig. 3). More damage occurred on lower Bayou Lafourche and in some parishes along the Mississippi River; in these areas high percentages of tops were broken in C.P. 48-103 and C.P. 44-101. Less damage occurred in the Western and Northern areas.

Immediately prior to Hurricane Betsy, the U. S. Department of Agriculture Crop Reporting Board estimated that Louisiana would produce an average of 28 net tons of cane per acre. After the storm the American Sugar Cane League estimated that Louisiana would produce an average of 23 net tons of cane

---

1/ Climatological Data for Louisiana 70(9): 1965. Weather Bureau, U. S. Department of Commerce, Asheville, N. C.

per acre.[2] The final yield was 22.5 net tons of cane per acre. The reliability of the pre-hurricane yield forecast may be estimated on the basis of past performance. U. S. Department of Agriculture Crop Reporting Board estimates, made on September 1 for the 10-year period 1954-63, show a standard deviation of 2.2 tons per acre. The probable yield, without hurricane damage would have been between 25.8 and 30.2 net tons of cane per acre. From the standard deviation it may be shown that a significant reduction in cane yield as a result of the hurricane did occur, and that the probable loss was between 12 and 28 percent.

The cane yield reduction experienced in 1965 probably was not due to stand, or to height of the cane at the time the pre-hurricane yield estimate was made. These two important factors would be carefully evaluated in making the yield estimate; neither was affected by the storm. Therefore, the low cane yields obtained must have been due either to more cane left in the field as a result of the adverse harvesting conditions, or to lower average weights per stalk of cane sent to the mill.

More cane was left in the field in 1965 than in normal years, due to a combination of adverse harvesting conditions, shortage of labor in the areas where the cane suffered the most damage, and high labor costs. This loss varied from area to area and from farm to farm within an area. Observation indicated that this was an important factor in yield losses.

Average stalk weights are routinely obtained from first stubble cane of several varieties each fall at the Houma station. These weights are

---

2/ Chadwick, W. S. Suggested Hurricane Relief. The Sugar Bulletin 44:3, 1965.

based on maturity samples, taken bi-weekly from October 1 through December 1. The average weights for each sampling date are based on 3 or 4 25-stalk samples of hand-stripped cane of each variety, selectively topped in the last hard joint. Table 1 shows average stalk weights of 4 commercial varieties on 5 dates during 1960-63 inclusive, and 1965.

Table 1. Average weights in pounds of unbroken stalks in 1960-63 and in 1965 of 4 varieties on 5 dates

		Date					
Variety	Year	Oct. 1	Oct. 15	Nov. 1	Nov. 15	Dec. 1	Average
CP44-101	'60-'63	2.00	2.10	2.26	2.25	2.22	2.17
CP44-101	1965 1/	91	81	81	88	81	84
CP52-68	'60-'62 2/	2.21	2.30	2.36	2.50	2.50	2.37
CP52-68	1965 3/	88	83	89	74	84	84
CP48-103	'60-'63	2.28	2.38	2.48	2.54	2.62	2.46
CP48-103	1965 1/	86	74	77	80	66	77
N.Co.310	'60-'63	2.01	2.10	2.25	2.30	2.28	2.19
N.Co.310	1965 1/	91	88	81	82	95	87

1/ Expressed as a percentage of the stalk weight of the same variety on the same date in 1960-1963.

2/ 1963 data not available.

3/ Expressed as a percentage of the stalk weight of the same variety on the same date in 1960-1962.

The weighted average, based on the 1965 variety census[3/], shows an average reduction in stalk weight amounting to 16 percent for these 4 varieties which comprise nearly 86 percent of the acreage. This reduction falls well within the calculated range of 12 to 28 percent. The decrease in weight is due partly to the fact that the cane averaged 10 percent lighter on October 1, about 3 weeks after the hurricane, than on the same date in 1960-63. Also, in 1960-63 the stalks gained 13% in weight from October 1 to December 1, while in 1965, during the same period, the gain was only 3 percent.

Low stalk weight could be caused by low stalk volume, resulting from a reduction in rate of growth following the hurricane or by below average stalk diameter. Low stalk weight could have been caused also by low stalk density resulting from an excessive amount of pith, or by loss of moisture from the stalk as a direct or indirect result of root, stalk, and leaf damage caused by the storm.

While some pith was observed in the important commercial varieties on the experiment station, the amount was relatively small and in most cases occurred in the extreme upper portion of the stalks. Much of this would be removed by the topping blade on the harvester. Measurements made on commercial varieties in 1962 showed stalk densities ranging from 1.02 to 1.07 in non-pithy cane. Density determinations made in 1965 are shown in Table 2. Loss of a sufficient quantity of moisture to account for any appreciable proportion of the reduction in stalk weights would have caused

---

3/ Matherne, R. J. The Louisiana sugarcane variety census for 1965. Sugar Bull. 44:33-35, 1965.

marked reductions in stalk density. From these data it appears that the stalk density was normal in 1965 and was not responsible for low stalk weights.

Table 2. Average stalk density of 4 varieties of sugarcane in 1965

		Density 1/	
		Oct. 6 2/	Oct. 12 3/
N. Co. 310	1st St.	1.033	
C. P. 55-30	1st St.	1.064	
C. P. 55-30	Plt.		1.062
C. P. 44-101	Plt.		1.043
C. P. 52-68	Plt.		1.045

1/ Water = 1.00

2/ Averages of 20 stalks

3/ Averages of 12 stalks

Loss of moisture would also result in a reduction in normal juice extraction percent cane and an increase in fiber percent cane. This type of data is rountinely obtained in complete milling tests conducted each fall at the Houma station[4/].

In 1963 and 1965 complete milling tests were conducted on 11 C. P. and L. varieties of the 1960 and 1961 series that were in the advanced

_/4 Arceneaux, G., Krumbhaar, C. C., and Bisland, R. B. Testing cane to determine probable milling yield. Facts About Sugar. 28:350-353, 1933.

stages of the testing program. Of these 11 promising unreleased varieties, 8 gave a higher normal juice extraction percent cane and had a lower fiber percent cane in 1965 than in 1963. For the 11 varieties, the average normal juice extraction percent cane was .8 of a percentage point higher, and the average fiber percent cane was .7 of a percentage point lower in 1965 as compared with 1963. Similar results were found with the important commercial varieties C.P. 52-68 and C.P. 44-101. Data for C.P. 52-68 (Table 3) show both higher normal juice extraction and lower fiber percent cane than for any year tests were conducted except 1964 which was also a hurricane year. Data for C.P. 44-101 (Table 4) are more extensive and complete, since this variety has been used as a standard in the milling program for many years. Data for this variety also show higher normal juice extraction and lower fiber in 1965 than for any year except 1964.

Table 3. Normal juice extraction and fiber content of C.P. 52-68, 1955-1965

Year	No. of samples	Normal juice extraction percent cane	Fiber percent cane
1955	2	81.83	11.17
1956	2	80.13	11.54
1957	6	78.48	13.19
1958	2	80.25	12.20
1964	2	81.66	10.28
1965	13	82.41	10.74

Table 4. Normal juice extraction and fiber content of C.P. 44-101. 1955-1965

Year	No. of samples	Normal juice extraction percent cane	Fiber percent cane
1955	2	82.96	10.99
1956	8	80.89	11.35
1957	10	79.51	12.64
1958	8	81.71	11.16
1959	8	80.55	11.67
1960	8	81.87	10.66
1961	8	81.64	11.12
1962	8	81.95	10.24
1963	13	80.73	11.39
1964	12	84.02	9.77
1965	9	83.15	10.22

If there had been appreciable loss of moisture from the stalks in 1965, normal juice extraction percent cane should have been reduced and fiber percent cane increased. Since all available mill data from the experiment station show the opposite effect, it may be concluded that no appreciable loss of moisture from the millable stalks occurred as a direct or indirect result of the hurricane.

The other factor that could cause low stalk weight is low stalk volume. This factor may be subdivided into diameter and length. While no stalk diameter data are available, it may be of interest to note that

if a stalk with an average diameter of one inch is reduced in average diamater by only 1/16 inch the loss in weight would be over 12 percent.

Growth measurement recorded at the Houma station showed that on September 8 C.P. 44-101 was 1 inch shorter in 1965 than for the 9-year average, 1955-1964. Average growth from September 8 to October 1 is 15 inches. Previous work at this station showed that the 15 inches of additional growth increased the stalk weight by about 11 percent in this variety[5/]. Since it has been shown (Table 1) that the weight per stalk on October 1 was 10 percent below normal, either the cane made little growth during the period September 8 - October 1, or the stalk diameter was below average. Growth retardation may have been caused by the damaged root system plus stalk and leaf damage. Below normal growth during the period October 1 - December 1 probably resulted partly from the above factors, and partly from the fact that rainfall was severely limiting, since less than 1 inch of rain was recorded in October. Cane usually does not increase in weight after the early part of November.

Data from the Houma station indicate that the loss in cane yield due to Hurricane Betsy amounted to between 12 and 28 percent, and that this loss was due partly to cane left in the field, and partly to low stalk weights resulting from severely reduced growth rates following the storm.

5/ Davidson, L. G. Effect of height of topping on quality of mill cane in Louisiana. Sugar Bulletin 44:14-17, 1965.

Figure 1: U. S. Sugarcane Field Station, Houma, Louisiana, Cut B7R, twelve hours before hurricane Betsy.

Figure 2: U. S. Sugarcane Field Station, Houma, Louisiana, Cut B7R, 36 hours after hurricane Betsy.

Figure 3: U. S. Sugarcane Field Station, Houma, Louisiana, Cut B7R, 6 days after hurricane Betsy.

A REVIEW AND DISCUSSION OF SOME RECENT CHANGES IN CANE HANDLING

J. Nelson Fairbanks
American Sugar Cane League, New Orleans, Louisiana

During the last few years changes in the cost structure of the Louisiana sugar industry have created the concern of cane growers and factory management to consider a general appraisal of the methods of harvesting, transporting and handling sugar cane. This concern has been sparked by several factors. Included among these are: (1) increased cost of labor disproportionate to other costs, (2) ever increasing problems in obtaining a sufficient amount of desirable labor, and (3) availability of some new and different types of cane hauling and handling equipment.

Within the last two years many people in Louisiana have concerned themselves with studying and analyzing ways and methods of increasing efficiency in handling and transporting cane. Several research studies and reports have and are being made in this area. Also, within the last couple years several factories in Louisiana have made some significant changes in their methods of cane handling. Some other factories have made and are making plans for changes this year.

Because of the many and varied situations and conditions existing in Louisiana which effect cane handling we have not, as yet, become completely settled on just what is the one or two best methods to adopt for supplying cane to the factory for the full 24 hours of the day.

The purpose of this paper is to review some of the systems, innovations, and recent experiments in cane handling under Louisiana conditions and briefly analyze and discuss each. Let me emphasize at this time that in dealing with the problems of cane handling and making economic appraisals of the various

systems, I have purposely not concerned myself with who bears what cost. All the operations involved from the time the cane is picked up from the heap row until it has been placed on the mill cane carrier have been analyzed as though they were components of one overall operation. My only interest is to determine if a particular method offers a cost saving, and now whom the saving may accrue to, whether it be the grower, the trucker or the factory. If a new system is more economical than the old system, and is adopted, I am sure it can be worked out between interested parties so that all segments of the industry will benefit.

General Systems and Variations

Other than the conventional sling bundle method of hauling and handling cane in Louisiana the two other general systems, which by now have become fairly well known to most all sugar people in Louisiana, are the chain-net and side-dump methods.

In a recent study where a comparison was made between each of these three systems it was found that both the chain-net and side-dump systems (wagons and trailers) showed lower costs per ton of cane delivered from heap row to mill carrier.[1]

---

[1]For a summarized comparison of the three systems, see Appendix Tables 1, 2, 3, and 4 and Figure 1. These tables and graph were reproduced (with minor changes) from the report "Handling and Transporting Sugar Cane in Louisiana - A Comparison of Three Systems," by J. Nelson Fairbanks, and support, in part, some of the statements and conclusions of this paper. This study was made during the 1964 crop harvest and reflects the equipment used at that time. Since the 1964 crop harvest the side-dump wagons being sold for Louisiana harvesting by J & L Engineering Co. are somewhat different from the ones analyzed. The new single-axle side-dump wagons, which are generally towed in trains of two, are somewhat lower priced per ton of capacity than those analyzed in 1964 and, therefore, the cost per ton of cane handled is probably more in line with the chain-net wagon handled cane.

This analysis was made for cane delivered to the factory in both wagons and trailers for direct feeding to the mill and did not include the cost of storing cane for night feeding.

For the purpose of this discussion let us consider cane handling under two separate categories: (1) cane hauled direct from heap row to factory in field wagons and unloaded directly onto the feed table, and (2) cane that must be transferred from field wagons to trailers for delivery to the factory.

Direct Delivery in Field Wagons

Both the chain-net and side-dump wagons, when delivering cane direct to the factory for unloading onto the carrier, completely eliminate the use of slings. Consequently, both require less labor in the field and at the factory than the old sling method. Usually at least one worker per loader, and probably two, can be eliminated in the field by using either of the bulk handling systems. About three workers can be eliminated per unloading unit at the factory. In addition, by eliminating slings in the field the efficiency of the loader can be increased. Even though the chain-net and side-dump wagons have higher initial costs than conventional wagons, the increased efficiency in field loading causes the cost per ton to be lowered. Likewise, the unit costs of unloading cane in bulk directly onto the feed table at the factory is lower than the cost of unloading cane in slings because less labor is required, unloading is faster, and over the long run, equipment costs are less.

For cane located close enough to the factory to be delivered direct in wagons, the chain-net and side-dump systems appear to be about as efficient as any system we can have today under our present method of harvesting.

(i.e., cane mechanically cut and placed in heap rows and loaded with grab type loaders). However, further cost reductions using either of these methods can be obtained by increasing the amount of cane hauled per towing unit per day. This may be accomplished by (1) increasing the number of wagons per towing unit, (2) reducing waiting time at the factory, and (3) hauling longer hours per day, such as hauling at night.

The question probably comes to your mind as how far is it economically feasible to haul cane direct to the factory in wagons? This depends on several factors but (other things being equal) the main determining factors are the amount of cane hauled per towing unit per trip and the traveling speed of the unit from field to factory. Of course, the greater the tonnage per unit and the faster the speed, the farther the distance in which it is more economical to haul direct to the factory.

In general, and without going into too much detail, the study showed that cane can be hauled in a two-wagon chain-net unit (which hauls between 6 and 7 tons per trip) up to about 5 miles cheaper than it can be transferred and hauled that distance in a chain-net trailer with a 24-ton load. Hauling distances greater than 5 miles from the factory favor transferring to the trailer. If a third wagon is added, making a three-wagon train and hauling about 10 tons, it becomes more economical to haul direct to the factory in wagons at distances up to 9 miles.[2]

I think just about everyone will agree that the goal in cane handling in Louisiana is to completely eliminate the slings. By using side-dump

---

[2]Figure 1 in the Appendix can be referred to for a graphical and more detailed comparison of the systems analyzed.

and chain-net wagons to haul direct to the factory that aim is accomplished. However, not all the cane is located close enough to the factory for direct delivery and, therefore, a great amount must be transferred from field wagons to trailers.

At this point I should mention that those who used side-dump wagons in Louisiana experienced considerable difficulty in using these wagons under muddy field conditions.

The new J & L side-dump wagons (model C-20,000) with single-axle, used for the first time in 1965 at Glenwood and St. James factories, were an improvement over the tandem-axle model (C-11,000) that were used in 1964 at St. James; however, more improvements will be necessary before these wagons can be depended upon for use in the mud.

Cane That Must be Transferred for Delivery to the Factory

Up to now those factories and growers who have switched to bulk handling in Louisiana, either in part or totally, are still having to rely on field derricks or draglines to transfer cane from conventional wagons to bulk-type trailers. Therefore, the same old inefficient sling method is being used in the field and at the field derrick.

The solution then, in completely eliminating slings, will be an effective and efficient method of transferring cane without slings from field wagons to trailers.

Since most factories are geographically located so that a considerable amount, if not all, of the cane needed to feed the factory during the daylight hours is or can be delivered in wagons for direct dumping, when we talk about cane that must be transferred to trailers we are actually talking about cane that, for the most part, is to be stored and used for night

feeding. In viewing it in this respect, an efficient method or system of transferring bulk cane is closely related to the method of storing and/or supplying cane for night feeding at the factory.

There are several methods of providing bulk handled cane for the factory at night. Some of these are:

1. Storage Pit and Bridge Crane
2. Storage Under Factory Derrick (dumped in bulk under derrick and restacked for feeding)
3. Storing in Trailers
4. Night Hauling (wagons and trailers)
5. Unloading and Stacking Under Derrick with Mobile Hydraulic Grab-type Loader - Unloader
6. A combination of 2, or more, of the above.

Several of these methods have been tried in Louisiana. Some have been adopted. Others are still in the experimental state and many factories have not completely decided on what changes they would like to make.

The key factor, or certainly at least one of the key factors, to successfully adopting an economical system for providing cane at the factory 24 hours a day is the development of an efficient method of transferring bulk cane into trailers.

Before briefly discussing some of these possibilities for transferring cane, I have some slides of some of the various cane handling methods which I would like to show at this time.

SLIDES:

Dumping chain-net wagons under factory derrick.

Cajun's bridge crane system.

Lula's trailer loading, storage, and unloading with chain-net trailers.

Lula's night hauling from the field in chain-net wagons.

St. James' storage in windrow piles and loading with mobile hydraulic grab loader into side-dump trailers for delivering to the factory as needed.

Other selected equipment.

Since most of you are familiar with the majority of these handling methods I will discuss only the very newest and still somewhat experimental methods which were used at St. James and Lula factories during the 1965 harvest.

Storage Away From the Factory and/or Transfer Loading Via the Use of Mobile Hydraulic Transfer Loaders

Since this system offers the flexibility of being able to either transfer cane from wagons directly into trailers, or to transfer cane from wagons into a storage stack to be reloaded into trailers for delivery to the factory at a later time, it seems appropriate to analyze both possibilities together.

This system offers the following advantages:

1. It completely eliminates slings in the field and at the transfer point. Therefore, it eliminates at least one and possibly two men used to tie slings in the field. It also eliminates one or two workers that normally would hook and unhook and assemble slings at a field derrick or dragline.

2. The system has great mobility. Using open sided wagons, cane can be either transferred direct from wagons to trailers or unloaded and stacked in a windrow type pile for reloading later.

3. The transfer points can be located near the cane being harvested. This will increase the efficiency of the field hauling units or reduce the number of units required.

4. Cane stored in piles by this method can be reloaded and delivered

to the factory in trailers as needed. This method offers the advantage of permitting the reloading and hauling to be coordinated and controlled under single supervision. Therefore, individual farmers could stack their cane in a pile and disassociate their operation with the reloading and hauling.

5. By placing transfer loading and hauling to the factory under single supervision and by operating longer hours per day (possibly 24 hours) greater utilization of transfer loading and hauling units could be attained, thereby reducing this cost significantly.

6. By having a greater portion of cane delivered to the factory as needed, the amount of investment in storage facilities required at the factory would be reduced. Labor requirements at the factory would be reduced considerably.

7. The transfer equipment is suitable for uses other than cane handling and by using such equipment for other purposes during the off-season, fixed costs are spread and unit costs lowered.

Some of the possible disadvantages or drawbacks of the system we are here discussing are:

1. To operate effectively, good field roads to storage points would be required.

2. Small farms may lack sufficient volume to afford a hydraulic unloader.

3. Some additional work and expense would be required to make the necessary changes in present field wagons or to purchase or build the types needed.

4. Coordination between the factory and the hauling and loading units, under some situations, might be difficult without radio units.

Table 1-A shows estimated costs of handling cane using the mobile hydraulic equipment.

Table 1-A. Cost of Storing Cane Away from the Factory and/or Transfer Loading Via the Use of Mobile Hydraulic Grab Unloader and Loader.

Operation	Work Standard[a]	Labor Require-ments	Labor Costs	Equip-ment Cost	Total Cost	Cost Per Ton
	Gross tons per hour	Number	Dollars	Per Hour		Dol-lars
Unloading (into windrow-type stack with tractor-mounted loader)	40	2	2.05	5.62[b]	7.67	.192
Reloading (from windrow stack into side-dump trailers with truck-mounted loader)	60	2	2.55	8.10[c]	10.65	.178
Transfer Loading (using truck-mounted loader to transfer cane direct from open-sided wagons to side-dump trailers)	50	3	3.55	10.95[c]	14.50	.290

[a]The work standard (the volume of cane that can be handled under good management) is estimated based on a relatively few observations over a limited time period.

[b]Equipment cost based on Prentice Model TMS-1 unloader with 13'6" boom (approximate installed cost $3600) mounted on 4020 John Deere, or equal.

[c]Equipment cost based on Prentice Model FOBC loader-unloader with 18' boom mounted on 2½ ton, single-axle truck-tractor.

If you stop with only a comparison of the costs per ton shown in Table 1-A and the costs for transfer loading by other methods shown in Table 1 in the Appendix, you would conclude there is no advantage in the use of the

mobile hydraulic unloader-loader equipment. As I have previously pointed out, the real potential advantages of this equipment lies in the savings it would make possible (1) in getting the cane from the heap row to the transfer point, (2) in hauling the cane from the transfer point to the factory, and (3) in factory yard facilities and labor.

Storage or Partial Storage of Cane in Trailers

As shown in the slides two new operations were used at Lula factory during the 1965 harvest: (1) Direct hauling from the field in chain-net wagons during part of the night, and (2) trailer shuttle system and partial storage in trailers for night feeding.

As I stated earlier, with our present method of harvesting in Louisiana, the cheapest way to handle and haul cane--provided the cane is within a reasonable distance from the factory -- is direct to the factory in either chain-net or side-dump wagons. Also, as previously stated, one of the best ways to reduce these costs is to increase the use of the hauling units by hauling longer hours per day. The night hauling operation at Lula, using the chain-net wagons, accomplishes that. In addition, the factory handling costs were reduced because less cane had to be stored. Also, a factor which may even be of equal or greater importance for both the farm and factory is the better quality, fresher cane provided by this system.

The main problems of hauling at night with wagon units would seem to lie with providing adequate safeguards against highway accidents. The system would probably have to be restricted to operating only on field and private roads and not over public highways.

The other portion of Lula's shift to bulk handling of cane is the

trailer shuttle system and partial storage in trailers.

Briefly, this system works as follows: Three truck trailers, with hydraulic fifth wheels, operate 12 hours per day and transfer 20 trailers back and forth from 2 trolley type field derricks to the factory. As loaded trailers are brought to the factory they may be either unloaded, or unhooked and parked for storage. Whether the trailers are unloaded or parked is determined largely by the length of line at the dumping station, the time of day they arrive, and the availability of empty trailers at the factory. Normally, during the morning most trailers are unloaded as they come to the factory and during the later part of the day, almost all of them are parked for night storage. The truck-trailer towing units lose practically no time because unhooking from a trailer and hooking onto another requires only about 2 minutes; and when an empty trailer is returned to the field derrick a full one is ready to be moved to the factory.

During the night shift only two truck-tractors were used to dump the trailers. In addition, after the trailers were emptied 10 of them were moved back to the field derricks (5 to each derrick) and parked under the derricks for reloading the next morning. From the past year's experience, the management at Lula found out that the night shift could handle more trailers than were being used.

With a shuttle system such as this, the number of towing units for the day and night shifts can only be worked out by trial and error. The distance which transfer stations are located from the factory is the key factor affecting the number of trailers that can be handled per towing unit. The two derricks used at Lula were located about 4 and 6 miles from the

factory. With this setup Lula was able to obtain as many as 2.5 loads per trailer per day.

Although I do not have a detailed cost analysis of the Lula trailer shuttle and storage systems at this time, the system seems to offer some definite advantages. Some of the most important are:

1. Low labor requirements. A total of five truck drivers (three on the day shift and two on the night shift) were hauling and unloading forty to fifty trailer loads per day. The management said that the 3 truck-tractors and drivers could handle more, possibly as many as 35 trailers.

2. Increased utilization of truck-tractors which reduces the fixed costs per ton of cane hauled. The high efficiency of truck-tractors is attributable to practically no lost time at the field derricks or factory and because they are operated 24 hours per day.

3. Eliminates storing the cane in a large pile and thereby eliminates double handling at the factory before the cane reaches the mill carrier.

As far as the operational efficiency, the main area in which this system at Lula could be improved upon, as I see it, is in the transfer loading from field wagons to trailers. The slings were not eliminated in the field and at the transfer station. It is my understanding that the management at Lula plans to make a change that will eliminate slings entirely for this operation.

While on the subject of storing cane in trailers let me make a few general observations. First, I want it to be clear that I am not advocating storing cane in trailers. On the other hand, I am not opposing it. Every factory has a somewhat different set-up from another and I haven't analyzed enough operations to have developed accurate cost guidelines.

However, from the cost and performance information that I do have it appears that from the standpoint of investment, commercially priced trailers used for storing cane would require an investment per ton of storage capacity higher than most of the possible methods mentioned earlier. The two main factors that can make storing cane in trailers more feasible however, are: (1) obtain a bulk-type trailer at a relatively low cost and (2) get a high rate of performance out of the trucks and trailers used.

Lula seems to have accomplished these two things very well in their operation. They built their own chain-net trailers at an appropriate cost of $3600 each and with only 3 truck-tractors (only 2 operating at night) they were able to haul each day more than twice the storage capacity of the trailers.

In the following example I have illustrated the effect these two factors (initial cost and daily performance) have on storage costs. The two example situations illustrate only the fixed costs of the trailers that would be charged to storage costs.

	Example #1 (One Load Per Trailer Per Day)	Example #2 (Two loads Per Trailer Per Day)
Initial Cost of Trailer	$5,000	$3,600
Annual Depreciation (10 yr. life)	500	360
Interest, Insurance & Taxes	210	168
Total Annual Fixed Cost	710	528
Daily Fixed Cost (70 days per yr.)	10.14	7.54
Fixed Storage Cost per Ton (20 tons per trailer)	.51	.19

The combined effect of starting with a $3,600 trailer rather than a $5,000 trailer and getting two loads per day (one dumped during the day and one for night storage) rather than one load means a cost reduction of 32 cents per ton of cane.

Summary and Conclusions

The old method of handling and hauling cane in slings is inefficient. It is more inefficient now than it was a few years ago. It will be more inefficient in the future than it is now because of the high labor requirements and rising wage rates. Not only has the wage rate trend been increasing at a much more rapid pace than other costs but the availability of suitable labor has been diminishing. There is nothing to indicate a change in these trends.

Handling and hauling full-length cane direct from field to factory in bulk-type dumping wagons (either chain-net or side-dump) seems to be the most efficient method we have today under our present Louisiana harvesting methods. By increasing the amount of cane hauled per towing unit per day, the per ton costs can be further reduced. This can be done by: (1) hauling at night, (2) adding another wagon to the tractor, (3) reducing waiting-time, and (4) increasing traveling speed.

For cane that must be transfered to trailers for hauling to the factory, the chain-net and side-dump trailers offer an efficient method, provided an efficient method of transferring from wagons to trailers is perfected. The method of transferring cane from conventional wagons in slings by field derricks or draglines is inadequate and costly since slings in the field and at the field derrick have not been eliminated.

The system of transferring cane with mobile hydraulic grab type equipment has merit. More work and experience, however, is needed to develop the design of the wagons and the grab. But based on limited experience it appears this system would facilitate storing cane away from the factory for delivery as needed. Also, it would present the oppor-

tunity to consolidate reloading and hauling under one management. In order to achieve maximum efficiency this seems necessary.

It would appear that some of the features of the Lula system and some of the features of the St. James system could possibly be combined to make a system that would be more economical than either is at present. If a system offers an overall cost saving it would seem reasonable to assume that the entire Louisiana sugar industry would benefit.

APPENDIX

NOTE: The tables attached as an appendix to this paper are summary tables reproduced (with minor changes) from the report "Handling and Transporting Sugar Cane in Louisiana - A Comparison of Three Systems" by J. Nelson Fairbanks. These summary tables are based on specific items of equipment which were generally used during the 1964-crop harvest. For those who wish to analyze in detail the cane handling costs by the various methods, including detailed costs of all equipment, a copy of the complete report can be obtained upon request from the American Sugar Cane League.

Table 1. Handling Costs Per Gross Ton of Cane, Using Various Types of Equipment

Operation	Work Standard	Labor Requirements[a]	Labor Costs[b]	Equipment Cost[c]	Total Cost	Cost Per Ton[d]
	Gross Tons per hour	Number	(Dollars	Per Hour)		Dollars
Field Loading:						
Conventional Wagons	49	5	4.750	5.476	10.226	.209
Side-Dump Wagons	51	4	3.850	5.745	9.595	.188
Chain-Net Wagons	55	4	3.850	5.573	9.423	.171
Transfer Loading:						
Field Derrick						
Conventional Trailers	59	5	5.200	6.995	12.195	.207
Side-Dump Trailers	48	5	5.200	7.669	12.869	.268
Chain-Net Trailers	48	5	5.200	7.374	12.574	.262
Dragline (5/8 yd. size)						
Conventional Trailers	74	5	5.700	9.857	15.557	.210
Side-Dump Trailers	60[e]	5	5.700	10.531	16.231	.271
Chain-Net Trailers	60	5	5.700	10.236	15.936	.266
Unloading at Factory:						
Factory Derrick						
Conventional Trailers	100	5	6.750	13.743	20.493	.205
Dragline (1 yd. size)						
Conventional Wagons	134	5	6.250	14.005	20.255	.151
Dragline (5/8 yd. size)						
Chain-Net Wagons	213	3	3.750	12.930	16.680	.078
Chain-Net Trailers	330	3	4.250	13.626	17.876	.054
Wagons & Trailers (50-50 ratio - unloading time)	272	3	4.000	13.278	17.278	.064
Hydraulic Side-Dumper:						
Side-Dump Wagons	173	2	2.400	10.813	13.213	.076
Side-Dump Trailers	252	2	2.900	11.632	14.532	.058
Wagons & Trailers (50-50 ratio - unloading time)	212	2	2.650	11.222	13.872	.065

Table 1 (Con't)

Operation	Work Standard	Labor Requirements[a]	Labor Costs[b]	Equipment Cost[c]	Total Cost	Cost Per Ton[d]
	Gross Tons per hour	Number	(Dollars	Per Hour)		Dollars
Feeding Factory From Storage						
Factory Derrick (with grabs)	120	1	1.500	10.564	12.064	.101

[a]Labor requirements shown for each operation include the driver of the vehicle being loaded or unloaded. Even though there may be no work required of the worker, he is present and is being paid and must be costed to the operation.

[b]Labor costs per hour are based on U.S.D.A. 1964-crop minimum rates for field workers and the approximate factory rates paid for the particular type of factory work.

[c]Equipment cost includes the cost of all equipment directly used in each operation. In the case of unloading at the factory, this includes the feeder table. The equipment cost data shown for transfer loading and unloading at the factory includes the following costs for hauling units in addition to the cost for loading and unloading equipment:

A. Transfer Loading:
   1. Field tractors and wagons:
      (a) 100% of total costs per hour.
   2. Truck-tractors and trailers:
      (a) 100% of fixed costs per hour.
      (b) 100% of variable repairs and maintenance costs per hour.
      (c) 25% of hourly fuel and engine oil road costs.

B. Unloading at Factory:
   Same as for transfer loading with the exception of fuel and engine oil costs for truck-tractors towing side-dump and chain-net trailers. These costs would be 50% of hourly fuel and engine oil road costs.

[d]Derived by dividing total cost per hour by work standard.

[e]Work standard is estimated to be the same as that of loading chain-net trailers with a dragline becuase the operations are similar.

Table 2. Effect of Factory Grinding Rate Upon Unloading Costs at Factory Per Gross Ton of Cane, by Side-Dump and Chain-Net Direct Dumping Systems[a]

Conveyance	Unloading Capacity Per Unloading Unit	Factory Grinding Rate (Gross Tons of Cane Per 24-Hour Day)											
		3000		4000		5000		6000		7000		8000	
		Unloading Units Required	Cost Per Ton	Unloading Units Required	Cost Per Ton	Unloading Units Required	Cost Per Ton	Unloading Units Required	Cost Per Ton	Unloading Units Required	Cost Per Ton	Unloading Units Required	Cost Per Ton
	Tons Per 24-Hour Day	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Side-Dump:													
Wagons	4152	1	.106	1	.079	2	.127	2	.106	2	.090	2	.079
Trailers	6058	1	.116	1	.087	1	.070	1	.058	2	.100	2	.087
Wagons & Trailers[b]	5088	1	.111	1	.083	1	.067	2	.111	2	.095	2	.083
Chain-Net:													
Wagons	5112	1	.133	1	.100	1	.080	2	.133	2	.114	2	.100
Trailers	7920	1	.143	1	.107	1	.086	1	.071	1	.061	1[c]	.054
Wagons & Trailers[b]	6528	1	.138	1	.103	1	.083	1	.069	2	.118	2	.104

[a]Direct dumping refers to unloading cane directly onto mill carrier feed table. Per ton costs in the table assume all equipment involved is used only during daytime (12 hours) and no cane is stored by the handling methods shown.

NOTE: The number of unloading units is the number of "unloading stations" i.e., feed tables with power unit (hydraulic dumper for side-dump equipment and dragline for chain-net equipment) required at each grinding rate. It should be pointed out that both the side-dump and chain-net type handling methods could be adapted for use with overhead bridge cranes for storage and night feeding. When the factory grinding rates exceed the capacity of one unloading unit and two units are required, but both units are not being fully utilized for direct feeding, factories with bridge crane storage could conceivably use one of the unloading units partially for storage. In such situations the costs shown above would be reduced.

[b]Unloading time divided on a 50-50 ratio between wagons and trailers.

[c]With a high rate of efficiency the 80 additional tons per day, required for the 8,000 ton per day rate, could easily be attained with one unloading unit.

Table 3. Hauling Costs Per Gross Ton of Cane Per Mile, by Type of Conveyance.

Conveyance[a]	Load[b]	Load Cost Per Mile Traveled[c]	Ton Cost Per Mile Traveled[c]	Ton Cost Per Mile Hauling Distance[d]
	(Tons)	(Dollars)	(Dollars)	(Dollars)
Field Wagons:				
Two Conventional Wagons	6.50	.225	.0346	.0692
Three Conventional Wagons	9.75	.239	.0245	.0490
One Side-Dump Wagon (J & L Eng. Co. Model C-11,000)	6.00	.242	.0403	.0806
Two Side-Dump Wagons (J & L Eng. Co. Model C-11,000)	12.00	.287	.0239	.0478
Two Side-Dump Wagons (J & L Eng. Co. Model C-20,000)	8.00	.239	.0299	.0598
Two Chain-Net Wagons	6.40[e]	.231	.0361	.0722
Three Chain-Net Wagons	9.60[e]	.248	.0258	.0516
Trailers:				
Conventional Trailer	24.00[f]	.232	.0097	.0194
Side-Dump Trailer	24.00	.255	.0106	.0212
Chain-Net Trailer	24.00	.245	.0102	.0204

[a]All wagon units are assumed to be towed by the same size tractor, i.e., the "4020" John Deere, or equal (Table 12). All trailer units are assumed to be towed by the same size truck-tractor, i.e., the Chevrolet, model "6303", or equal (Table 7).

[b]The load shown for each type conveyance (except conventional trailers and J & L Model C-20,000 wagons) is the average weight obtained for the 1964 harvest adjusted to reflect normal weights of previous years. The adjustment is approximately 15% upward from the actual 1964 weights. Load weight for Model C-20,000 wagons is the estimated average load in a normal season based on load weights experienced during 1965 crop harvest at St. James Cooperative.

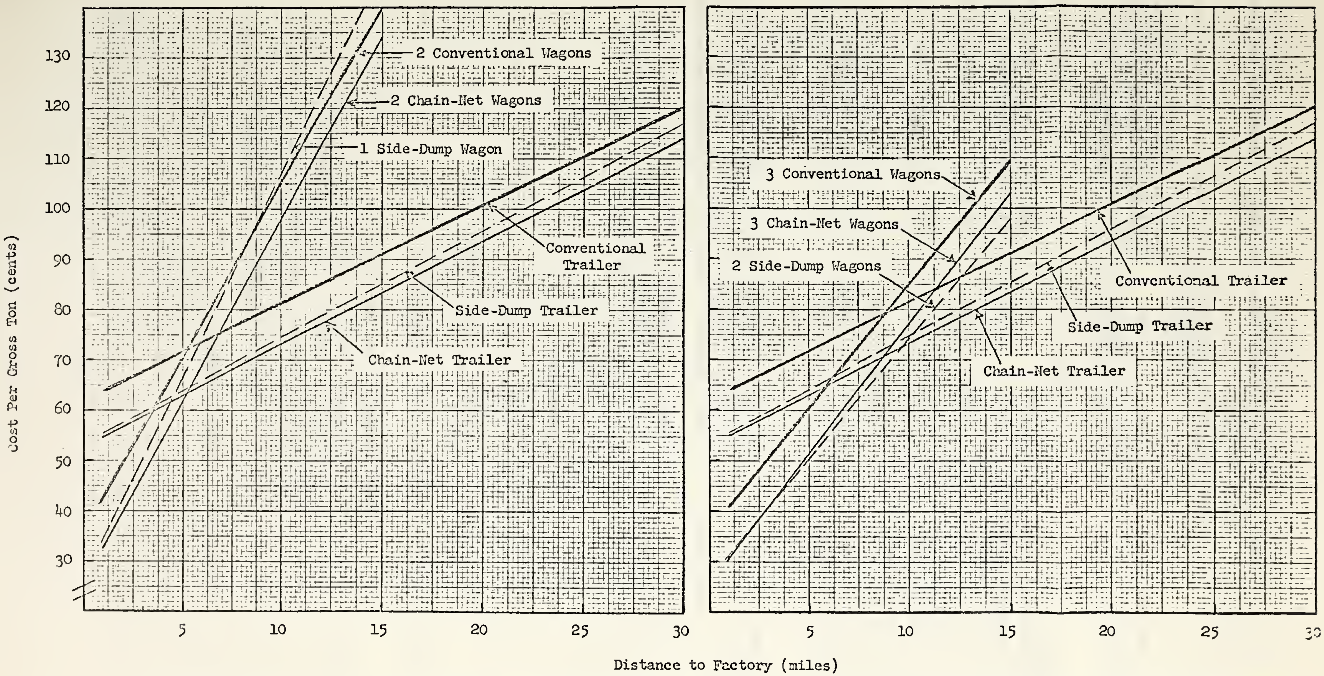
[c]This cost applies to each mile traveled to and from the factory. The cost per mile is based on the traveling speeds of 16.65 and 29.24 m.p.h. for field tractors and truck-tractors, respectively.

[d]Hauling distance is the distance from the farm or field derrick to the factory.

[e]These load weights reflect average load weights obtained at Oaklawn and Raceland factories(load weight of 3-wagon units projected from 2-wagon units). The actual average load weight obtained at Cajun in 1964 was 7.5 and 11.6 gross tons, respectively, for 2-and 3-wagon units.

[f]The actual average gross tonage of cane per truck-trailer (conventional trailer per load in Louisiana) is greater than 24 tons under normal conditions. Loads exceeding 24 tons for single-axle truck-tractors and tandem trailers usually are in violation of Louisiana highway regulations.

Figure 1. Cost of Delivering a Gross Ton of Cane from Heap Row to Mill Carrier, Using Various Systems, at Various Hauling Distances.[a]



[a]Costs included are (1) field loading, (2) transfer loading at field derrick (for cane hauled by truck-trailer), (3) hauling to factory, and (4) unloading at the factory. Not included are cost of waiting to unload at the factory and cost of hauling from field to field derrick. Since waiting costs vary widely dependent upon type of conveyance and length of waiting time, Table 5 should be considered in conjunction with the graph. The additional cost for hauling from field to field derrick can be derived from Table 3.

Table 4. Waiting Costs at Factory, Per Hour and Per Gross Ton of Cane, by Type of Conveyance[a]

Conveyance	Load	Total Cost Per Hour[b]	Cost Per Gross Ton Min. of Waiting Time/Fac. 5	10	15	30	60
	(Tons)	(Dollars)	Dollars				
Field Wagons:							
Two Conventional Wagons	6.50	3.751	.048	.096	.144	.288	.577
Three Conventional Wagons	9.75	3.988	.034	.068	.102	.204	.409
One Side-Dump Wagon (J & L Eng. Co. Model C-11,000)	6.00	4.020	.056	.112	.168	.335	.670
Two Side-Dump Wagons (J & L Eng. Co. Model C-11,000)	12.00	4.762	.033	.066	.099	.198	.397
Two Side-Dump Wagons (J & L Eng. Co. Model C-20,000)	8.00	3.972	.041	.083	.124	.248	.496
Two Chain-Net Wagons	6.40	3.848	.050	.100	.150	.300	.601
Three Chain-Net Wagons	9.60	4.133	.036	.072	.108	.215	.430
Trailers:							
Conventional	24.00	4.204	.015	.029	.044	.088	.175
Side-Dump	24.00	4.878	.017	.034	.051	.102	.203
Chain-Net	24.00	4.583	.016	.032	.048	.096	.191

[a]All wagon units are assumed to be towed by the same size tractor, i.e., the "4020" John Deere, or equal (Table 12). All trailer units are assumed to be towed by the same size truck-tractor, i.e., the Chevrolet model "6303," or equal (Table 7).

[b]Hourly costs include the following costs:

(1) For field tractor and wagons:

(a) 100% of <u>total</u> costs per hour.

(2) For truck-tractor and trailers:

(a) 100% of <u>fixed</u> costs per hour.

(b) 100% of variable repair and maintenance costs per hour.

(c) 25% of hourly fuel and engine oil <u>road</u> costs.

(d) 100% of labor costs.

CANE PLANTER PRINCIPLES

Mansel M. Mayeux
Associate Agricultural Engineer
LSU, Baton Rouge, Louisiana

The planting operation is the last obstacle to a completely mechanized sugar industry in Louisiana.

The problem of planting cane is complicated by several factors. Seed cane is not uniform in size, length or degree of curvature, nor is it practical to clean it prior to planting. Planting rates may be considered to be massive in comparison to other crops. Seeding rates vary from 2 to 4 tons per acre. The planting season is relatively short so the machine must pay off with low rates of annual usage. The final job must be perfect or nearly so for three crops are usually harvested from one planting. Acreage controls further necessitate perfection.

The objectives of any sugarcane planter can be divided into two parts. The first objective is to separate two to three stalks of cane from a bundle. The second is to take these two to three stalks and drop them in a selected pattern in a previously opened furrow. The task of opening the seed furrow, covering the seed cane and loading the cane into planting carts has been mechanized as a separate operation for some time.

Let us consider some of the components which may be used to build a machine to meet these objectives. We might start with a semi-mechanical planter. The first objective, that of separating two to three stalks from the bundle can be accomplished by hand. The second objective, that of dropping these into the seed furrow at a prescribed rate can be done mechanically. The task of hand separation can be made easier, if the

material is kept convenient to the operator and the cane is loaded in an orderly manner with all butt ends oriented to the operator. The seed cell must be big enough so that the loader can butt the cane evenly in single lengths in the seed cart. A hydraulic bottom capable of keeping the cane at a convenient height to the operator is helpful.

The second objective is that of dropping the two to three stalks at a prescribed rate. Here we might use one of four devices to advantage. The first is a continually rotating feeder which will drop the cane in the row. At planting time, sugarcane contains a large amount of leaf trash. The continually rotating feeder will tend to wrap trash. This can be improved upon by using an intermittently rotating valve. An indexing drive such as the geneva drive works very well in conjunction with this rotary feeder. Consider a rotary feeder with two positions located 180° apart. The seed cane is placed in the feeder while it is stopped. The indexing device moves the feeder ½ revolution and stops allowing it to discharge. The opposite half is filled while in this position and the cycle repeats itself. This gives a positive ratio, it gives the operator a clear indication of when to feed the machine and does a good job of lapping the cane.

A third device which may be used for this purpose is two canvases operating in opposite directions. Here the two slatted canvases come together grasping the sugarcane and conveying it to its final destination. This is a simple and positive feed which will work whether the cane is straight or crooked. Timing devices must be placed on the canvas so that the operator will know when to feed the cane.

A fourth type of device is the conventional sticker chain similar to

that used on sugarcane harvesters. The operator merely feeds the sticker chain which conveys the cane to the ground.

Regardless of the type of feeding device, the drive must be synchronized with the forward speed of the planter. A variable feed drive which can be precisely adjusted to any particular pattern is ideal. It is possible, however, to use a combination of sprockets to do a similar job.

What can be expected from machines of this type? Careful tests have not been accomplished. Based on limited experience, it is estimated that perhaps as much as 25 to 35 percent reduction in planting labor can be obtained with this method. Planting labor here refers to the labor required to drop the seed piece in the row and not the total labor required to plant sugarcane. On a total basis, the reduction would be less than this.

From lessons learned in the calculus, we know that any object cut in small enough lengths will be straight and uniform. It is conceivable that if we cut sugarcane in small pieces, a completely mechanical operation can be desived for planting these short pieces. Basically, a planter of this type might look something like this. The cane would be received in a V-bottom cart. At the bottom of this V would be a series of saws which would cut the cane to some prescribed length. As the cut pieces are removed, the flow of plant cane continues downward. The short pieces must be removed in a continuing operation so that they can be deposited in the row in a prescribed manner. This principle has been worked on and there are patents on a machine of this type.

Experiments here at the University on this type of machine have not

been favorable. The cane was cut in 24" pieces. Much difficulty was experienced trying to get the mass of cane to flow downward. The problem was further complicated by biological factors which must be taken into consideration. In Louisiana, sugarcane is planted during the late summer and early fall. Short pieces at this time of the year germinate extremely well. During this intermittent period, seed pieces are attacked by fungi and disease. There are no fungicides available which will offer control over a period of at least three months. The spring germination is reduced considerably. The results of two years test at the University showed that extremely gappy stands resulted when this type of planting took place. The stands were very acceptable for early August planted cane but were totally unacceptable for October and November planted cane. For this reason, the work on this type of planter was discontinued several years ago.

The next mechanism which should be considered in constructing a sugarcane planter is one that grabs the cane at one position only. This has much appeal. To avoid grabbing positions on two different canes when removing cane from the bundle, it is almost mandatory that the cane be grabbed from one point only. The problem becomes one of choosing which point. Early experiments were conducted catching the sugarcane in the center. Picture, if you will, sugarcane stacked with care, one length only, in a semi-conventional cane cart. The feeder must be located at the top of the cart and the cane bundle moved upward to the feeder. The feeder rotates in a plane perpendicular to the direction of travel. In conjunction with an indexing drive, the feeder enters the outer top edge of the bundle, grabs two to three stalks, rotates 180° and drops the cane to the ground (see figure

II). Problems are involved of course. The sugarcane must be continuously kept at a level and brought to the side of the trailer where the grab operates. This principle has possibilities. The mechanics of it have never been completely worked out.

Perhaps the most promising place to grab the sugarcane is not in the center but at the butt end. Basically, the stalk would be grabbed in one spot near the butt end and slipped out of the bundle by mechanical fingers. After clearing the cart bed it would be allowed to drop into a previously opened seed bed. Picture, if you will, (see figure III), a machine consisting of a planting arm with cam actuated grabs suspended over the rear of the seed trailer. The action of the grabs must be synchronzied through a ground drive or otherwise with the forward travel of the seed cart. As the load is planted, the arm moves downward. The arm is balanced so that pick up end of the arm rests on the cane lightly at all times. An operator must move the planting arm across the rear end of the trailer removing the load of seed cane in even layers off the top. A gauging device restricts the grabs to the proper depth. Such a planting arm may have grabs all in one line or in more than one line. If they are attached in single tandem, it may be possible to build a narrower machine which will work into the corners of the planting trailer to better advantage. The grab must be held open as it enters the cane, close when in contact, then withdraw the cane to the rear of the planting arm where it can be dropped to the ground. In tests conducted on a machine of this type at LSU, it was possible to plant cane at rates of as high as two miles per hour. The machine used six grabs in single tandem spaced 48" apart and averaged 1.85 stalks per grab. It missed completely 5 percent of the

time. It was found necessary to keep one man on the ground to even out and further straighten the cane in the furrow. Since cane is grabbed at one point, a machine employing this principle is not limited to straight cane though it certainly operates better and with much less power when this type of cane is available. The machine tested at LSU lacked mobility. It was a trail behind machine. There is a commercial machine on the market which is self propelled and eliminates the mobility problems referred to.

The successful operation of a machine of this type begins with the cutting of the seed. Either machine or hand cut cane should be laid on the heap row with all butt ends in the same direction. The planter must operate from a specially constructed trailer with false endgate. The loader should load carefully in small grabs and butt all cane to the rear of the trailer against the false endgate. On arrival in the field to be planted, the false endgate is removed and the trailer is attached to the planter tractor. An operator drives the tractor and the second operator keeps the planting arm into the load and moving from side to side.

How near will a machine of this type come to meeting the objectives set forth at the beginning of this paper? It is apparent that it would accomplish this purpose. Traveling at the rate of 1½ to 2 miles per hour and with good mobility it is anticipated that a machine of this type should have a capacity to plant 8 acres of sugarcane per day. It is normally accepted in the cane industry that it requires 8 man hours to drop sugarcane by hand. Using this type of machine, it should be possible to save 6 man hours per acre. If we consider the labor as costing $1.00 per hour, then it is possible that this machine could reduce the labor requirements by $6.00 per acre.

Figure I - Semi-mechanical planter with intermittently rotating feed-
er and hydraulic seed cell bottoms.

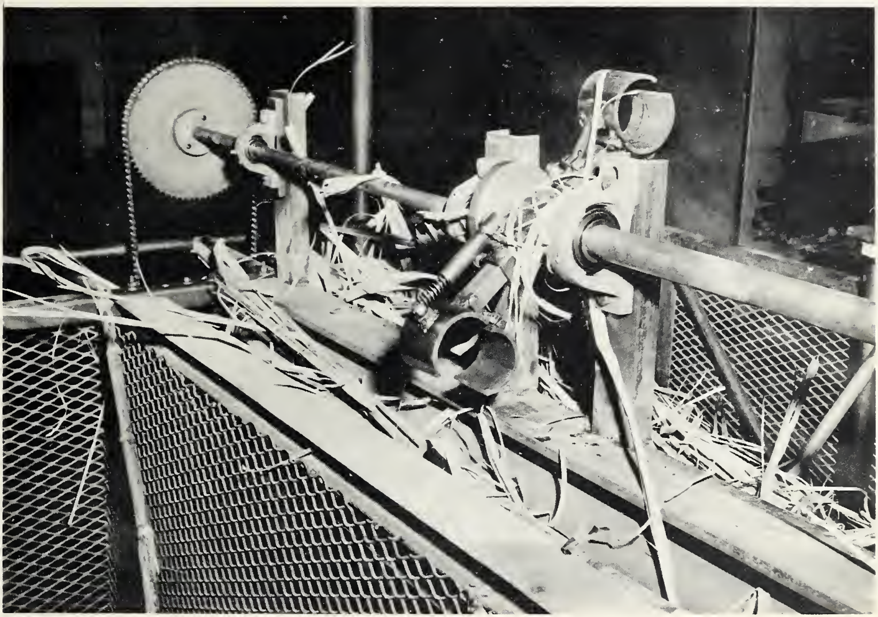


Figure II - Intermittently rotating cam actuated grabs remove stalks from the top of the load and deposit it in center chute.

Figure III - Planting arm with cam actuated grabs catch cane by butt end and slide it out of seed cell and deposit it in previously opened furrow.

Let us consider for a moment what this would mean in terms of an investment. On the basis of a planting season of 30 working days, we see then that a machine of this type would have a capacity of 240 acres per year. With a saving of $6.00 per acre, this would result in a gross savings of $1400.00. Since this machine has not been in the field for any length of time it is rather difficult to estimate the life and the annual maintenance. Due to high obsolescence, it is my considered opinion, that a life of five years would probably be a maximum. It would be foolhardy to anticipate a maintenance of less than $300 per year. If our assumptions are correct, then the net return from this machine would be $1400 - $300 or $1100 per year.

The present value of $1100 per year compounded annually at 6% for five years is $4788.

The farm operator must keep in mind certain other facts. To take advantage of a machine of this type, the planting season must be stretched out to a maximum which means tying up tractors for opening and closing the seed furrow and harvesters and loaders for handling the seed. A better management job will have to be done to keep from having equipment operators standing around.

In summary, it must be said that a mechanical planter is well within the realm of possibility. It is not dependent on inventing new technology. What is needed is the sound application of engineering and manufacturing skill. Though it will not be economically feasible for the small operator, it appears to be practical for the larger growers. Semi-mechanical planters serve a useful purpose. Their cost is such that their use is not restricted to any size operation.

FERTILIZATION OF SUGARCANE UNDER MINIMUM CULTIVATION

L. G. Davidson, Research Agronomist, Crops Research Division,
Agricultural Research Service, U. S. Department of Agriculture,
U. S. Sugarcane Field Station, Houma, Louisiana.

Minimum cultivation of sugarcane may be defined as the fewest field operations necessary for a satisfactory profit. Obviously, cultivation could be reduced to the minimum required for planting the cane, but if this reduced profits appreciably it would not be acceptable to the grower.

We may assume that if the usual fertilizer materials are applied in the off-bar furrow in the normal manner, the recommended rates of application of nitrogen, phosphate, and potash, would be adequate, both for normal and for minimum cultivation. However, if no cultivation is done after fertilization, it may be necessary to place fertilizer a little deeper than normal. Heavy rains tend to flatten the row, thus exposing fertilizer that is not placed deep enough in the off-bar furrow. Exposure of the fertilizer to the air may result in loss of ammonia to the air, and possible loss of nitrate and potassium by leaching.

Many source-of-nitrogen experiments have shown that yields of sugarcane and sugar per acre are increased by the same amounts when equal rate of application of nitrogen are applied in the off-bar furrow, regardless of the source of nitrogen. Nitrogen sources compared were anhydrous ammonia, aqua ammonia, ammonium nitrate, urea, nitrate of soda, calcium nitrate, cyanamid, and ammonium sulfate. Since anhydrous ammonia is the cheapest source of nitrogen, it is the most important nitrogen fertilizer for sugarcane. Nitrogen in the form of anhydrous ammonia or aqua ammonia must be placed several inches below the surface of the soil to prevent serious loss.

With the high rates of application of nitrogen now being used, it is important to take advantage of the cheapest available source of nitrogen. It is doubtful that it would be economically feasible to omit this cultivation-fertilization operation. Its omission would, however, require the surface application of the more expensive solid nitrogen materials -- probably ammonium nitrate or urea. The nitrogen application could be broadcast on the soil, either by ground machines or by airplane. Surface application of ammonium nitrate or urea would probably result in some loss of ammonia to the air, and possible loss of nitrate by leaching. The extent of these losses might be very difficult to determine in the field. The effect of small losses of nitrogen on yields of cane could be determined only by a series of carefully conducted field experiments.

Phosphate is rapidly fixed by the soil, becoming much less available to the crop. To minimize fixation losses, phosphate is usually applied in bands on both sides of the row in the off-bar furrow. In this way the soil in contact with the fertilizer band may be saturated with phosphate, and its availability not too greatly reduced. A minimum cultivation program conducted without the off-barring operation would require some other method of placement of phosphate. The choice of other methods of application or placement would be determined by cost, efficiency of the applied phosphate, and labor requirements. Phosphate may be banded on both sides of the row as phosphoric acid, using knife coulters, giving ideal placement of this material. Phosphate fixation would be reduced on soils that have been limed to a pH of 6 to 7. The broadcast application of granular or pellet forms of phosphate -- either by ground machines or by airplane -- on a soil with a pH of 6 to 7, followed by a row-building cultivation might

give satisfactory results provided sufficient phosphate is applied. However, we have no experimental data to support this assumption.

Potash is generally applied in bands on both sides of the row in the off-bar furrow. If off-barring were omitted in a minimum cultivation program, potash could be applied in solution by using knife coulters. Potash is absorbed or fixed by the soil, but to a considerably lesser extent than phosphate. The amount of potash absorbed or fixed by the soil is generally greatest in heavy soil and least in light soil.

Plants are able to use the more easily exchangeable absorbed potash. Thus it might be feasible to broadcast the potash by airplane or by ground equipment, followed by building the row. However, the efficiency of potash applied on sugarcane in this manner has not been determined.

A minimum cultivation program which included the off-barring operation would permit the use of the normal fertilizer materials, rates of application, and placement. If off-barring is to be omitted, other methods of placement must be used. These methods have been discussed without recommendation, since their value has not been proven experimentally.

MINIMUM CULTIVATION OF SUGARCANE

R. J. Matherne, Research Agronomist,
Crops Research Division, Agricultural
Service, U. S. Department of Agriculture

Sugarcane farmers are interested in minimum cultivation to reduce the cost of production and to help ease the growing problem of scarce labor. The number of cultivations that a sugarcane crop receives in Louisiana varies greatly. Growers disagree as to the number of cultivations necessary. Moreover, weather conditions very often determine how many the crop will receive. As many as eight or more cultivations are not uncommon. On the other hand, crops sometimes receive only one cultivation. This occurs when the land is wet over a prolonged period, making more frequent cultivation impossible.

No experimental data are available at present on minimum cultivation. At the Houma station we have started two experiments on minimum cultivation. Dr. Millhollon, Weed Control Research Agronomist, has one experiment. E. R. Stamper, the L.S.U. Weed Specialist, is also working on this problem. Donnie Roane, Jeanerette, La., had some trials in 1965 with no cultivation during the crop year. Warren Harang, Jr., Thibodaux, La., has also had trials with no cultivation.

We do have information on some practices bearing directly on the subject. In 1948, S. J. Rodrigue, Edgard, La., began to practice the idea of "off-barring" and "dirting" back in the same operation (1). High yields produced on this plantation indicate his success with it. In 1957, L. P. Hebert and R. J. Matherne reported on a series of experiments comparing off-barring and modified off-barring (table 1) (2). Treatments did not differ significantly.

In 1963, Hebert and Matherne reported on a series comparing dates of dirting sugarcane (3). Three dates were used: April 1, April 15, and April 25. Table 2 shows the shoots per acre in June and the number of millable stalks at harvest time. Table 3 shows cane and sugar yields. There were no significant differences between treatments.

Results indicate that cultivations can be reduced at off-barring time. They also indicate that the "lay-by" cultivation can be made earlier in the season than formerly believed. Number of cultivations can be reduced without a sacrifice in yields.

A drastically reduced number of cultivations involves problems. Heavy rains may leave the rows too flat for efficient harvesting. A broadcast application of herbicides would seem desirable. This, however, would increase the cost substantially, particularly with high-priced residual herbicides. In some years such a program to succeed would be more difficult than others. Different soil types generally require different management. Fields harvested under adverse conditions become more difficult to manage. Early "Dirting" should not depress yields when an adequate stand exists. Frequently, however, some delay in "dirting" becomes necessary for weak stands in an attempt to encourage maximum tillering. Finally, increase popularity of multi-row equipment should help to decrease both cost of production and labor requirements.

LITERATURE CITED

(1) Rodrigue, S. J., 1963. Producing sugar cane in Louisiana without putting it on the off-bar. Sugar Bul. 42:33-35.

(2) Hebert, L. P. and Matherne, R. J., 1957. Comparisons of the usual off-barring with a modified method of off-barring on yields of sugarcane in Louisiana. Sugar Bul. 35:119-123.

(3) Hebert, Leo P. and Matherne, R. J., 1963. Effect of date of spring dirting on yields of sugarcane and sugar in Louisiana. Sugar Bul. 41:97-101.

TABLE 1. Average yields of cane and sugar with four varieties in two series of experiments comparing off-barring and modified off-barring in Louisiana during the years 1952 to 1955, inclusive.

Series and Variety	Off-barred			Modified off-barred		
	Yield of cane per acre	Indicated Yield of 96° Sugar at harvest: Per ton of cane*	Indicated Yield of 96° Sugar at harvest: Per acre	Yield of cane per acre	Indicated yield of 96° sugar at harvest: Per ton of cane*	Indicated yield of 96° sugar at harvest: Per acre
	tons	pounds	pounds	tons	pounds	pounds
1952-1954 C.P. 36-105	24.82	192.5	4778	25.32	193.2	4892
" " C.P. 43-47	25.29	212.4	5371	23.64	214.0	5058
" " C.P. 44-101	35.03	199.7	6995	35.14	202.5	7116
Av. of 3 varieties	28.38	201.4	5715	28.03	203.0	5689
1953-1955 C.P. 36-105	27.89	183.5	5118	26.22	189.0	4956
" " C.P. 44-101	35.60	183.8	6543	35.02	179.0	6270
" " C.P. 44-155	27.92	199.9	5581	26.45	197.1	5212
Av. of 3 varieties	30.47	188.6	5747	29.23	187.4	5479
Av. of 2 series All varieties	29.42	194.8	5731	28.63	195.0	5584

* All sugar-per-ton yields are weighted values.

TABLE 2. Shoots per acre in June and millable stalks at harvest in date-of-dirting experiment with 3 sugarcane varieties at Houma, La., during 1956-1959 (average of 6 tests).

Variety	Early Dirting			Medium-early dirting			Late Dirting		
	No. of shoots on: June 1	No. of millable stalks		No. of shoots on: June 1	No. of millable stalks		No. of shoots on: June 1	No. of millable stalks	
	1,000	1,000	Percent of number of shoots	1,000	1,000	Percent of number of shoots	1,000	1,000	Percent of number of shoots
C.P. 36-105	57.2	24.9	43.5	63.0	25.8	41.0	93.7	26.6	28.4
C.P. 44-101	56.0	25.0	44.6	63.2	25.6	40.5	82.7	26.7	32.3
C.P. 48-103	50.5	20.4	40.4	53.4	20.9	39.1	64.7	21.5	33.2
Average (percent)	100	100		110	103		147	106	

Differences required for significance for number of shoots on June 1:

Between treatments, any variety .05 = 3.65
.01 = 4.81

Between treatments, average of 3 varieties .05 = 6.68%
.01 = 8.80%

Differences between number of millable stalks not statistically significant.

TABLE 3. Cane and sugar yields in date-of-dirting experiment with 3 sugarcane varieties at Houma, La., during 1956-1959.

Variety and date of dirting	Plant cane: Yield of cane per acre	Plant cane: Indicated yield of 96° sugar: Per ton of cane	Plant cane: Indicated yield of 96° sugar: Per acre	First stubble: Yield of cane per acre	First stubble: Indicated yield of 96° sugar: Per ton of cane	First stubble: Indicated yield of 96° sugar: Per acre	All experiments: Yield of cane per acre	All experiments: Indicated yield of 96° sugar: Per ton of cane	All experiments: Indicated yield of 96° sugar: Per acre
	tons 1/	pounds 2/	pounds 1/	tons 1/	pounds 2/	pounds 1/	tons 3/	pounds 2/	pounds 3/
C.P. 36-105:									
Early	88.4	174.6	15,439	77.1	181.9	14,025	27.6	177.9	4,911
Medium-early	88.5	175.4	15,520	77.0	180.0	13,863	27.6	177.4	4,897
Late	93.4	180.7	16,874	80.1	184.7	14,793	28.9	182.6	5,278
C.P. 44-101:									
Early	83.1	189.9	15,784	86.4	182.6	15,779	28.2	186.5	5,260
Medium-early	87.9	190.8	16,768	87.5	181.7	15,903	29.2	186.4	5,445
Late	90.5	184.8	16,722	90.1	180.6	16,270	31.4	175.1	5,499
C.P. 48-103:									
Early	75.8	224.0	16,976	70.8	225.9	15,990	24.4	225.2	5,494
Medium-early	77.4	222.5	17,223	72.0	230.9	16,626	24.9	226.5	5,641
Late	79.7	232.6	18,539	75.5	229.0	17,289	25.9	230.5	5,971

Differences between treatments not statistically significant.
1/ Total of 3 crops
2/ Weighted value
3/ Average value for 1 crop

SOME OPERATING ASPECTS OF RING DIFFUSION

Jay Dornier, Engineer
for Silver Engineering

INTRODUCTION

The object of this talk is to give the sugar industry an up-to-date report on the operation of the Silver Ring Diffusion System. I am attempting to keep the presentation brief while providing as much useful information as possible to you on the subject and know that I will certainly not be able to answer all of the questions in every individual's mind. I do hope, however, that the information presented here will be of some interest to everyone present and that some of the questions you may have will be answered. The talk will be broken into four major topics:

1. Cane Preparation
2. Diffuser Operation
3. Bagasse and Press Water Handling
4. Economic Considerations

At the end of the talk, I will try to answer any questions you may have about the system.

SOME OPERATING ASPECTS OF RING DIFFUSION

1. Cane Preparation: The first piece of equipment for cane preparation is called the Buster. This piece of equipment was developed in order to provide a satisfactory primary cane preparation for the Hawaiian area where many rocks and considerable other foreign material is included with the cane sent to the diffuser. This buster is not considered necessary in areas where clean, hand-cut cane is sent to the process.

The Buster has a built-in feed system, designed for automatic control which we call the Buster Feed Rolls.

The variable speed buster feed rolls provide a very constant, uniform supply of cane into the buster. They are the primary means of controlling the input of cane to the diffuser.

The buster is a specially designed hammer mill which breaks the cane up into bundles of fibers three to five inches long. This allows the fiberizer to separate the individual fibers more efficiently in the second step of preparation.

The buster rotor turns about 1200 RPM. The hammers (which weigh over 40 lbs. each) swing on stainless steel pins fixed through the rotor discs. The design is extremely rugged and no maintenance problems have occurred other than the need to resurface the cutting edges of the hammers occasionally.

The buster requires about 4.2 HP per ton of prepared cane per hour depending upon the fiber characteristics of the cane fed into it.

The busted cane is conveyed to the fiberizer by a drag conveyor. The fiberizer is fed at the top by a single feed roll with a fixed speed.

The fiberizer is designed very much like the buster except that the hammers and grid are made to separate the individual fibers as much as possible. The proper separation of fibers is very important for best extraction, and it has been determined that a speed of 1200 RPM produces the best cane preparation. At this speed, the fiberizer requires about 3.7 HP per ton of cane per hour.

The buster and fiberizer have been designed for use with the diffusion system and are recommended as the ultimate in proper cane preparation. However, if a factory has a double set of knives, they may want to know if the knives can be used in place of the buster. In most cases the answer is "yes", and the feeling is that the use of two sets of knives <u>or</u> of one set of knives and a shredder in place of the buster will not reduce the extraction. It must be understood, however, that proper cane preparation affects the diffuser performance greatly and that every effort should be made to provide the best preparation possible.

The prepared fiber leaves the fiberizer on a drag conveyor. It conveys the cane to a continuous rubber belt conveyor with a continuous weighing scale. This scale provides a close control on the amount of cane fed into the diffuser by means of an automatic system connected to the buster feed rolls. After the cane has passed over the scale, it is deposited in the diffuser and extraction begins.

2. <u>Diffuser Operation</u>: The diffuser is designed to extract the most sugar from the cane and to filter the limed juice which percolates through the fiber bed by gravity. The position of this bed of fibers which is deposited in the diffuser does not change relative to the diffuser tank throughout the entire cycle. Filtration of the flocculated particles is very efficient because there is a good seal formed at the

sides of the tank and all of the juice has to pass through the bed of fiber. In this manner all juice is filtered.

The ring is operated most efficiently when the liquid level is about the same as the top of the bed and there is no loss in extraction potential due to efficient operation. The detrimental effect of communication between juice passes is prevented by the characteristic formation of an irregular bed in the ring diffuser tank. It has been determined that the bed characteristics as they exist at this time provide for a very stable operation with no problems caused by communication between passes even though the bed is flooded.

The diffuser is actually an annular shaped tank with a perforated plate bottom. There is a cover at the top which maintains a fixed position and is not attached to the tank. This cover is over the juice distributors and has observation doors so that inspection can be made of the bed conditions at various points in the diffuser. The juice receiving tanks are also fixed in position. They are under the diffuser tank so that as the juice percolates through the fiber bed, it is collected in them. One pump is connected to each tank. These pumps provide a counter-current flow of juice by moving it from the back of the diffuser to the front in definite stages or passes. Each pump in the diffusion circuit feeds a juice distributor located above the slowly moving bed of fiber. The diffuser is rotated from 0 to 3 RPH by a hydraulic drive system. The diffuser speed determines the average thickness of the bed of fiber in the diffuser since the feed rate is constant. The normal operating speed is 1 to 1.5 RPH but the diffuser can be operated at lower or higher rates with little difference in performance, depending on the cane and bed conditions.

Vertical elevating scrolls at the end of the diffusion cycle remove the wet bagasse from the system. The fiber is then conveyed to the pressing station or the mills, depending on equipment used.

The entire system which has been previously discussed is extremely reliable. Operation of the 3600 ton per day diffuser in Hawaii has shown that there is almost no time lost because of breakdowns or similar occurrences connected with the diffuser. There have been no major failures in the operation since 1964 when the mills were removed and the factory cane processed only by the diffuser. All points in the system which are exposed to wear have been designed for a long life.

CLARIFICATION

An added benefit of the ring diffusion system is that clarification of the juice may be done in the diffuser tank. Since it is necessary to add a certain amount of lime into the system in order to maintain the pH at a level which is not conducive to corrosion, it is very easy to add a small additional amount of lime in order to effect a clarification of the juice.

Automatic pH and temperature controls are used to maintain constant conditions for clarification in the diffuser. The constant conditions help to prevent the loss of sugar due to micro-organisms or enzymatic activity. The temperature of the cane entering the diffuser is immediately increased by the addition of juice heated to 190 degrees F. This increases the rate of clarification and helps to prevent loss of sugar due to bacterial action. A temperature of 160 degrees F. is maintained throughout the system after the initial heating by automatic addition of exhaust steam at various points in the circulating juice. The juice

which comes through the diffuser from the first pass is dirty, and it is recirculated through the bed before it is pumped to the boiling house. Before recirculation, however, this juice is passed through specially designed heaters to keep this pass temperature around 180 degrees F. The juice which leaves the diffuser and is pumped to the boiling house is very clear and has a high purity. It is pumped to a juice scale and weighed. Then it is pumped through juice heaters to the first evaporator body just as the juice from a conventional clarifier is handled. No measurable loss of sugar due to inversion has been found from the operation.

There have been some problems with scaling in the heaters and evaporators, but evidence is that with proper control of the diffuser clarification, the scaling is less than with conventional milling procedure.

At present, the sugar being produced at Pioneer Mill is good enough to get a bonus price for filterability, and the color is also good (6.0-6.2 index with 98+ pol).

3. <u>Bagasse and Press Water Handling</u>: The wet bagasse which leaves the diffuser contains little sugar. About 1% pol in bagasse (after pressing) is the highest figure for normal operation. The drying equipment, therefore, is just used to dry the fiber and no appreciable extraction is obtained after the fiber leaves the diffuser. We have had experience drying bagasse by three different methods: (a) Mills, (b) French Press, and (c) The Silver Cone Press. All three methods are suitable for drying the bagasse and some operating results are as follows:

(a) Mills which are in normal operating condition are capable of reducing the moisture in bagasse to 47%. This is for two mills in

series running with proper setting and speed.

(b) The French Press is capable of reducing moisture in bagasse to 47% under normal operating conditions with a requirement of about 5.5 horsepower per ton of cane per hour. (This is based on the performance of a Model J-88 at Pioneer Mill.)

(c) The Silver Cone Press is capable of reducing moisture in bagasse to 47% under normal operating conditions with a requirement of about 3.5 horsepower per ton of cane per hour. (This is based on the performance of a 36-inch model at Pioneer. Larger units should require less horsepower per ton of cane per hour.)

The liquid which is produced by drying the fiber in any of the three methods mentioned is called "press" water. This press water is returned to the system in the following manner:

(a) It is pumped over DSM screens to remove larger particles of fiber and imbedded impurities.

(b) The liquid with smaller particles from the DSM screen is sent to the press water heating tank and heated to 165 to 170 degrees F. The heated press water is pumped to a settling tank or to an existing factory clarifier. The return of dirty press water directly from the drying equipment to the diffuser may cause a drop in the percolation rate of juice through the bed and so reduce the extraction potential. The reduction in extraction would be caused by a flooding on the back end of the diffuser with a resultant change in the diffusion gradient. As most factories already have some suitable settling tank or clarifier arrangement, no additional equipment should be required.

The operation of the ring diffusion system at Pioneer Mill in Hawaii has shown that the effect of dirty cane on extraction and capacity is

much less with the diffuser than it is with a mill.

4. Economic Considerations: One of the definite advantages of the diffusion system is the recovery of more sugar from each ton of cane. Actual operating results over a period of more than fourteen months show that a minimum increase of 8 to 12 pounds of sugar per ton of cane can be expected over a typical milling operation, depending on the efficiency of the boiling house and the extraction which is obtained with an existing mill. The to-date average extraction of the 3600 ton per day diffuser at Pioneer Mill is almost 97.5 for this year.

Another advantage of the ring diffusion system is that more molasses is obtained. The purity of juice which comes from the ring diffusion system is at least as high as that from a mill and normally higher. The reason that more molasses is obtained per ton of cane is not because more impurities are removed per ton of sugar but because more sugar with a corresponding ratio of non-sugars is removed per ton of cane.

The power requirement of the diffusion system is approximately 107 horsepower per ton of cane per hour, excluding presses or mills for drying bagasse. For a 3600 ton per day unit only 1600 horsepower is required, or 2050 horsepower including the Silver Cone Presses. (It should be understood that the rated horsepower of motors and turbines used may be higher than this. The above figures only indicate what requirements are to operate the system at capacity.)

Maintenance costs on the diffuser and preparation equipment at Pioneer, based on processing over 700,000 tons of cane, are approximately 4¢ per ton. The maintenance cost, including the French Press, is approximately 10¢ per ton. The maintenance cost for five other Hawaiian plants using mills averages 28¢ per ton, so it is evident that the diffuser

requires little maintenance. No figures are available at this time on the maintenance cost of the Silver Cone Press, but it should also require little maintenance.

The diffusion system can easily be operated by one man. An operator is required to make any necessary changes to the system condition while it is in operation. He is also required to control the system for start-up and shutdown operations. The diffuser is designed so that normal operation is completely automatic.

If mills are used to dry bagasse, an additional operator may or may not be required to control them properly, but the French or Silver Presses are run automatically after start-up and should not require any additional labor.

In general, the Ring Diffusion System seems to be what most people in the industry need -- a more efficient, less expensive method to remove more sugar from their cane.

THE USE OF MAGNESIUM OXIDE TO PREVENT EVAPORATOR SCALING IN SUGAR FACTORIES

M. Saul Hoffman, Max F. Smith and Derek J. Twigg
Basic Incorporated, Cleveland, Ohio

INTRODUCTION

The authors present this technical paper to demonstrate how cane sugar factories around the world have increased production and lowered costs by using Magnesium Oxide to prevent scaling of evaporators and related equipment.

For centuries it has been common practice to chemically neutralize cane juices with lime because of its ready availability. Unfortunately, lime is the major cause of evaporator scaling because of the insolubility of the calcium compounds formed.

The concept of replacing lime with a non-scaling material was first considered practical in the late 1950's, when magnesium oxide was tested in Hawaiian factories. These original tests were extremely successful. Soon thereafter Magox, Basic's magnesium oxide, became economically practical and is now used throughout the world to lower cane sugar production costs.

The technical information presented herein should benefit factory personnel faced with the costly problems of scaling.

ELEVEN CRITICAL LOCATIONS

Imbibition Water - A constant percentage can be used throughout the run, because Magox provides scale-free evaporators which will operate at a constant rate. In addition, excess sucrose loss to bagasse is eliminated because imbibition water need not be decreased.

Lime Slurry Tank - This is where Magox is introduced. Less volume and weight of alkaline material is required when using Magox because only 540 pounds or kilos of Magox provides the same neutralizing effect of 1000 pounds or kilos of lime. No additional equipment is needed. Existing liming control instruments are completely suitable.

Juice Heaters - Magox reduces scale and fouling caused by calcium precipitates, thereby maintaining heat transfer efficiency.

Clarifier - Use of Magox results in higher density, faster settling mud with a consequent increase in clarifier capacity.

Mud Filters - With Magox, one filter can usually do the work of two because a thicker, denser mud is obtained. This greatly improves filter efficiency by virtue of the reduced volume of more easily filtered muds. It also provides a second benefit by reducing sucrose loss.

Evaporators - Magox eliminates formation of hard scale in evaporators. Included among the benefits of clean evaporators are the following:

(a) constant high level efficiency of evaporators.

(b) required syrup brix is maintained continuously.

(c) constant application rate of imbibition water can be maintained.

(d) maximum grinding rate can be expected, allowing long-term cane delivery schedules that could shorten the season.

(e) excessive shut downs for cleaning are eliminated.

(f) if only light cleaning is necessary, damage to tubes from mechanical cleaning or corrosion from acid cleaning is virtually eliminated.

(g) if Magox is used in low concentrations, the tube deposits are usually soft and easily removed.

(h) with Magox the concept of continuous operation of the boiling house can be realized. Clean equipment permits BALANCED EFFICIENCY of all components of the boiling process.

Syrup Lines, Valves and Vats - Magox eliminates replacement required because of damage inflicted during cleaning. Many mills have experienced completely clean lines at the end of the season, without any visible scale on valve seats, line fittings, instrumentation internals, and vessels.

Vacuum Pans - Reduces cleaning of the vacuum pan system. Magox does not form the hard, intractable calcium scale experienced with the use of lime alone.

Sugar Quality - In many instances lower ash content is obtained with Magox because less alkaline solids are necessary for neutralization. Therefore, less solids are carried through to the final sugar.

Molasses - Most factories report that less molasses is produced. This is attributed to the lower melassigenic effect of Magox as compared to lime.

Boiler Operation - It is possible to shut the boilers down earlier on the weekends, because clean evaporators permit the juice to be boiled off faster.

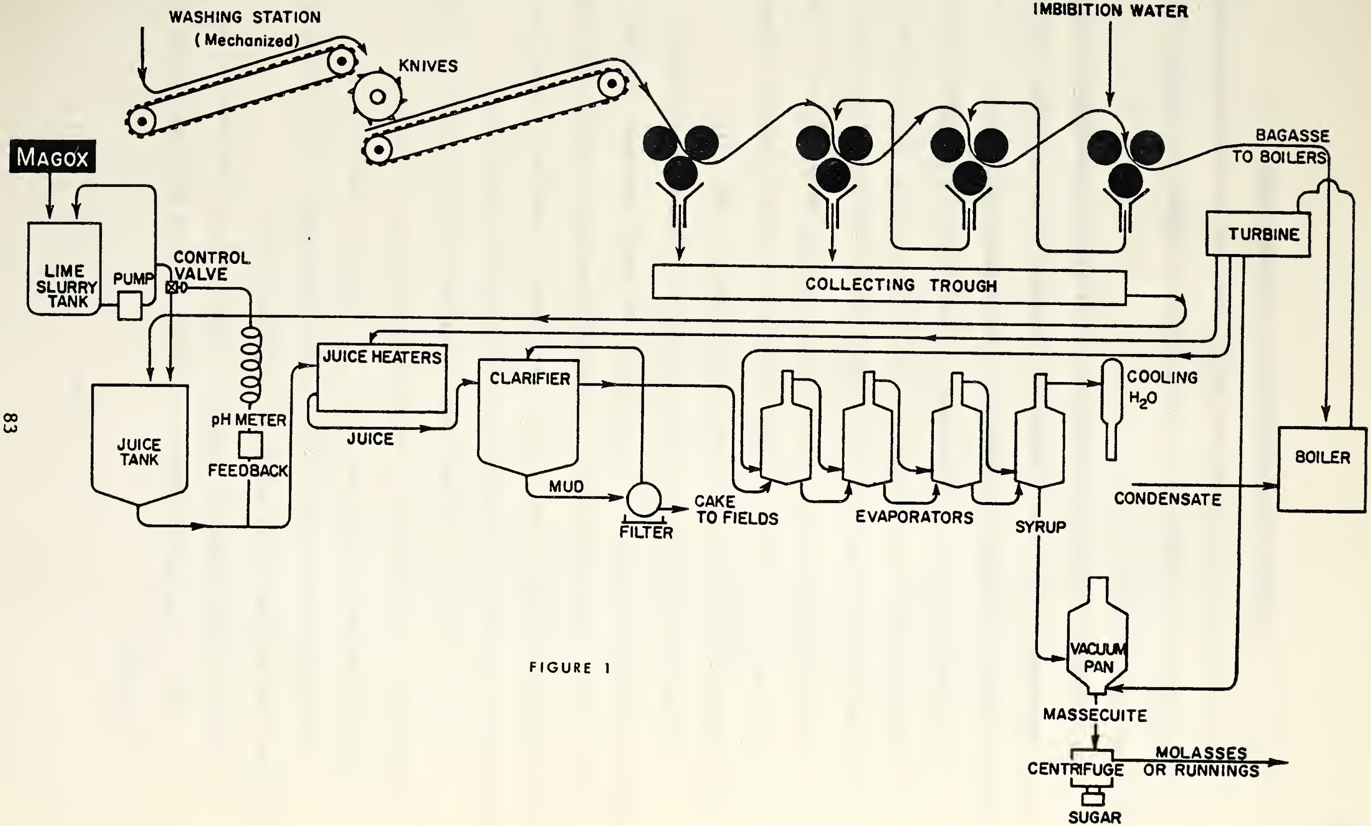

WASHING STATION
(Mechanized)
KNIVES
IMBIBITION WATER
MAGOX
BAGASSE
TO BOILERS
LIME
SLURRY
TANK
PUMP
CONTROL
VALVE
COLLECTING TROUGH
TURBINE
JUICE HEATERS
CLARIFIER
COOLING
H_2O
pH METER
JUICE
JUICE
TANK
FEEDBACK
BOILER
MUD
CAKE
TO FIELDS
FILTER
EVAPORATORS
SYRUP
CONDENSATE
VACUUM
PAN
MASSECUITE
CENTRIFUGE
MOLASSES
OR RUNNINGS
SUGAR

FIGURE 1

CHEMISTRY OF SCALE REMOVAL BY USING MAGOX

Magox, added to neutralize cane juice, forms soluble magnesium sulfate which does not precipitate out of solution, and consequently does not form scale on metal surfaces.

In contrast, hydrated lime forms calcium sulfate, which does precipitate out on evaporator tubes, valve internals, transfer lines and other equipment in the form of a very hard, difficult to remove intractable scale.

In actual practice, it is necessary to add only enough Magox to keep the calcium content of the limed juice below the critical level. This is called the "scaling potential" level, below which calcium scale will not form. Mill tests clearly illustrate this point as shown in Figure 2. This level will vary from factory to factory and from season to season, depending on operational variables, and must be determined for each mill.

In Figure 2, the calcium oxide in the mixed juice prior to liming showed a consistent value, as indicated by the week's average. The MgO content of the raw juice varied considerably, depending on soil conditions of various cane fields. These values are shown to establish a base line from which to ascertain the actual effect of Magox substitution.

The first six days utilized Magox substituted 42% by weight. As shown, calcium oxide was restricted to an average of less than 250 ppm, and the non-scaling magnesium oxide content was slightly less than 460 ppm.

Evaporators at the end of this week were perfectly clean because the calcium ion was kept below the point of precipitation.

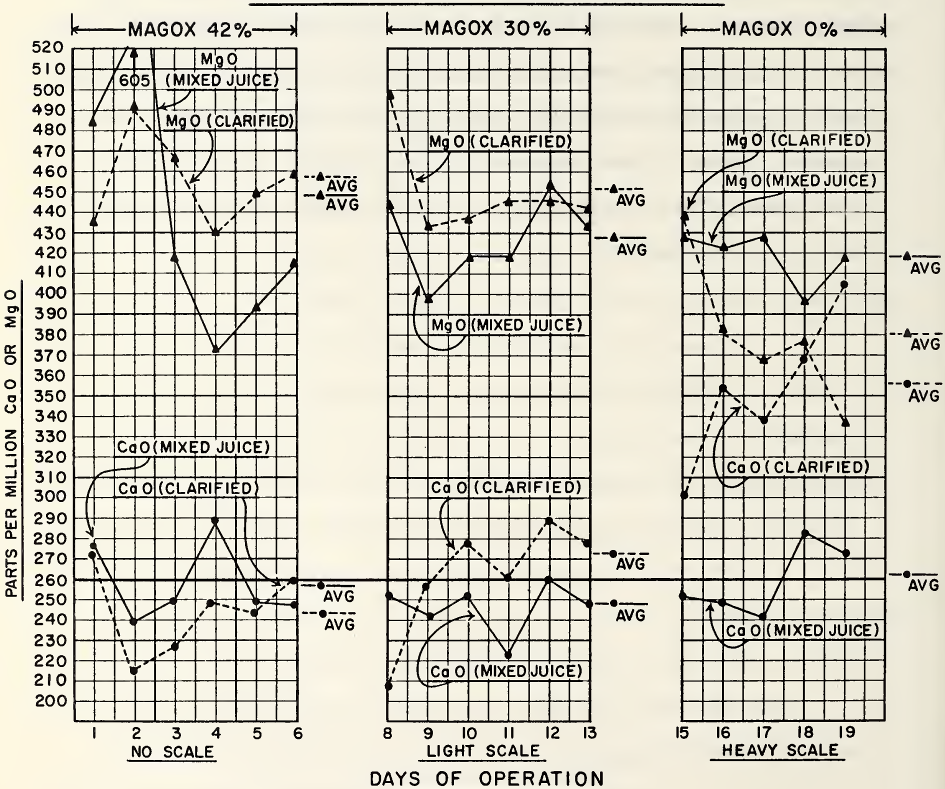
The next week, Magox was reduced to 30%, which allowed the calcium oxide content to surpass 260 ppm. A slight amount of scale was formed in the evaporators.

The third week, with Magox at 0% (100% lime), calcium oxide content increased tremendously to over 350 ppm. Scaling was severe.

In the process of investigating the causes and methods of preventing scale, it has been determined that the predominant inorganic constituent is usually calcium sulfate, which binds organic matter to a significant extent. Silica in the form of silica or calcium silicate is also usually present in the scales, generally varying in direct proportion to the degree of mechanization employed in harvesting. Calcium sulfate (gypsum) acts as a cement or binder to trap these normally non-scaling solids to form a thicker scale. Magnesium is present in the juices, but is almost never found as a constituent in the scales.

FIGURE 2

REDUCTION OF SCALE POTENTIAL WITH MAGOX



SCALE ANALYSES FROM SUGAR EVAPORATORS

The scale analyzed below was formed in the evaporators of Puerto Rican Centrals having mixed juice analyses as shown in the following tables. All scale samples were taken prior to chemical or mechanical cleaning.

FIGURE 3

LABORATORY ANALYSES (%)				
	Mill 'A'	Mill 'A'	Mill 'B'	Mill 'C'
Effect	3	4	4	4
Silica as SiO_2	12.0	23.0	5.2	1.9
R_2O_3	2.2	1.9	--	--
Aluminum as Al_2O_3	--	--	0.0	Tr.
Iron as Fe_2O_3	--	--	1.9	0.1
Loss on Ignition	27.6	36.0	24.7	26.5
Ether Extract	0.0	0.0	0.0	0.0
Phosphorus as P_2O_5	1.6	1.2	0.8	1.6
Calcium as CaO	21.6	18.3	27.4	30.8
Magnesium as MgO	0.0	0.0	0.0	0.0
Sulfate as SO_3	29.5	18.2	35.0	39.1
Carbonate as CO_3	0.0	0.9	0.0	0.0
Sodium as Na_2O	0.0	0.0	0.0	0.0
Copper as CuO	5.4	Tr.	4.7	Tr.
HYPOTHETICAL COMBINATIONS (%)				
Sodium Silicate	0.0	0.0	0.0	0.0
Calcium Carbonate	0.0	2.0	0.0	0.0
Organic	27.6	36.0	24.7	26.5
Calcium Sulfate*	47.9	31.0	59.5	66.6
Calcium Silicate	0.0	6.0	4.2	3.2
Silica	12.0	19.9	3.1	0.3
Sodium Sulfate	0.0	0.0	0.0	0.0
Calcium Phosphate	3.6	2.6	1.6	3.4
R_2O_3	2.2	1.9	1.9	0.0
Copper Oxide	5.4	Tr.	4.7	Tr.
Magnesium Silicate	0.0	0.0	0.0	0.0

*Major constituent in hard scale formation.

FIGURE 4

MILL 'A' EVAPORATOR JUICE ANALYSES WHICH FORMED SCALE AS SHOWN IN FIGURE 3

	1st Effect Influent	1st Effect Effluent	2nd Effect Effluent	4th Effect Effluent
Total Hardness as $CaCo_3$, ppm	2800	4400	4880	10,080
Calcium as $CaCO_3$, ppm	1600	2400	2580	5,370
Magnesium as $CaCO_3$, ppm	1200	2000	2300	4,720
Phenolphthalein Alkalinity as $CaCO_3$, ppm	0	0	0	0
Methyl Orange Alkalinity as $CaCO_3$, ppm	1160	2840	3320	5,400
Sulfate as SO_4, ppm	1810	2500	2660	6,520
Chloride as Cl, ppm	840	1360	1640	3,240
Silica as SiO_2, ppm	119	168	176	404
pH	6.20	6.65	6.60	6.70
Specific Conductance, micromhos	6800	10,400	9600	16,000
^{o}Brix	20.6	28.7	34.8	67.1
% Sucrose	14.3	23.2	28.2	55.0
Cycles of Concentration - Calcium		1.50	1.61	3.35
Cycles of Concentration - Magnesium		1.66	1.91	3.94
Cycles of Concentration - Chlorides		1.62	1.95	3.86
Cycles of Concentration - Sucrose		1.62	1.97	3.85
Cycles of Concentration - Sulfate		1.44	1.47	3.60

FIGURE 5

MILL 'B' EVAPORATOR JUICE ANALYSES WHICH FORMED SCALE AS SHOWN IN FIGURE 3

	Clarified Juice	Feed to Pre-Evap.	Effluent from Pre-Evap.	Effluent 2nd Effect	Effluent 3rd Effect	Effluent 4th Effect
Total Hardness as $CaCO_3$, ppm	1815	2170	2570	4260	4440	6070
Calcium as $CaCO_3$, ppm	1265	1420	1710	2910	2980	4120
Magnesium as $CaCO_3$, ppm	550	750	860	1350	1460	1950
Phenolphthalein Alkalinity as $CaCO_3$, ppm	0	0	0	0	0	0
Methyl Orange Alkalinity as $CaCo_3$, ppm	6160	6320	6800	520	4400	5560
Sulfate as SO_4, ppm	710	780	910	1560	1600	2200
Chloride as Cl, ppm	880	1140	1400	2280	2370	3160
pH - Lab	7.8	7.8	7.6	5.0	6.2	6.7
pH - Field	7.1	7.3	6.9	6.7	6.6	6.5
Specific Conductance, micromhos				5480	7140	4990
^{o}Brix	15.8	16.8	24.9	30.9	36.8	52.0
% Sucrose	12.2	15.2	18.6		29.2	43.4
Cycles of Concentration - Calcium		1.12	1.35	2.30	2.35	3.26
Cycles of Concentration - Magnesium		1.36	1.56	2.45	2.66	3.55
Cycles of Concentration - Chlorides		1.30	1.59	2.48	2.69	3.59
Cycles of Concentration - Sucrose		1.25	1.53		2.39	3.55
Cycles of Concentration - Sulfate		1.10	1.28	2.20	2.25	3.10

FIGURE. 6

MILL 'C' EVAPORATOR JUICE ANALYSES WHICH FORMED SCALE AS SHOWN IN FIGURE 3

	Clarified Juice	Effluent of Pre-Evap.	Effluent of 4th Effect
Total Hardness as $CaCO_3$, ppm	2280	3850	6560
Calcium as $CaCO_3$, ppm	1630	2680	4530
Magnesium as $CaCO_3$, ppm	650	1170	2030
Phenolphthalein Alkalinity as $CaCO_3$, ppm	0	0	0
Methyl Orange Alkalinity as $CaCO_3$, ppm	2250	2410	2540
Sulfate as SO_4, ppm	830	1420	2200
Chloride as Cl, ppm	800	1420	2460
pH - Lab	6.9	7.0	6.8
pH - Field	7.2	6.6	5.9
Specific Conductance, micromhos	6720	5270	2100
^{o}Brix	18.0	34.0	64.4
% Sucrose	14.4	26.1	44.1
Cycles of Concentration - Calcium		1.65	2.78
Cycles of Concentration - Magnesium		1.80	3.12
Cycles of Concentration - Chlorides		1.78	3.20
Cycles of Concentration - Sucrose		1.81	3.06
Cycles of Concentration - Sulfate		1.71	2.65

NEUTRALIZATION WITH MAGOX

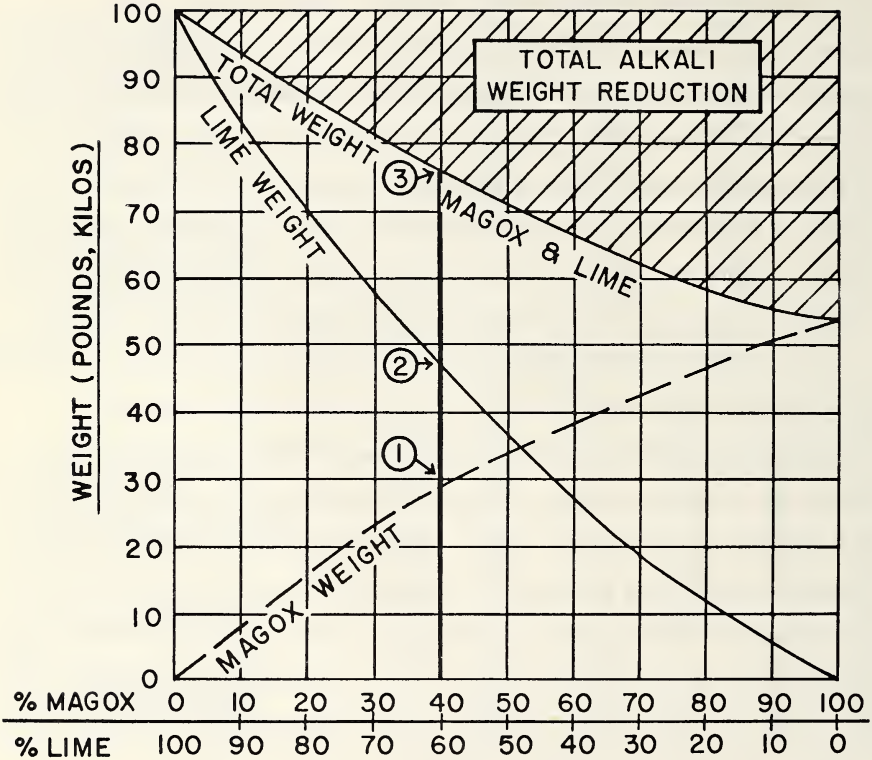
Because magnesium oxide reacts somewhat slower than lime, it is necessary to lower cold liming pH slightly in order to maintain the same clarified and syrup pH values. Magnitude of adjustment is affected by percentage of Magox added. Magox stabilizes pH at the proper level throughout the system. This is actually a benefit to some factories where an excessive drop in pH through the heaters and clarifiers causes high inversion losses. The lower liming pH afforded by Magox further assists in reducing scaling since it is well known that scaling increases in proportion to a higher liming pH.

Magox is a high performance alkaline magnesium oxide exhibiting approximately 1.85 times the neutralizing power of high calcium hydrated lime. As a result 540 pounds of Magox will neutralize the same quantity of raw juice as 1000 pounds of lime. When using Magox as a partial substitute in the liming process, total weight of the Magox/lime mixture is always less than if lime alone is used. This lowers the cost of Magox on the basis of effective neutralization, and reduces handling costs.

Magox is used with existing lime slurry tanks and pH controls, and requires no change in equipment.

Figure 7 shows the individual weights of the combination Magox/lime mixture (at various % concentrations of Magox) which will replace 100 units of lime alone. The shaded area in the graph shows total weight reduction resulting from the higher neutralizing value of Magox. The chart is valid for any unit of weight. Values shown are based on high purity lime of 90% $Ca(OH)_2$. Where lower purity limes are used, the advantage of Magox is even greater.

FIGURE 7



MAGOX / LIME % COMPOSITION

BASED ON 100 UNITS WEIGHT OF LIME ORIGINALLY USED

Example: Starting with the % Magox required, (this example shows 40%) draw a vertical line as shown. At the intersections read (1) Magox weight, (2) lime weight, (3) total Magox/lime weight required to replace 100 units of straight lime.

ADDITIONAL BENEFITS

Clarification - Magox results in slightly increased clarity in some mills due to formation of a denser, more rapidly settling mud.

Sugar Ash Content - Raw sugar analyses from many factories using Magox have shown that ash content has been lowered considerably. This is thought to be the result of adding less solids to the system by the use of Magox.

Reduction of Inversion Losses During Downtime - Magox tends to stabilize the pH level of the cane juice in clarifiers during periods of downtime, thus reducing inversion loss normally associated with pH drop.

Molasses Production and Purity - Magox tends to show a reduction of molasses produced as a percentage of net cane. It has relatively little or no effect on the purity of the molasses. Results of a Mauritian mill evaluation are shown in Figure 8 where Magox was used for two consecutive weeks at different levels. Then 100% lime was used for two consecutive weeks. This reduction in molasses is again thought to be due to the addition of less solids to the system.

FIGURE 8

	1st Week	2nd Week	3rd Week	4th Week
Magox % by weight	48%	40%	0%	0%
Molasses Purity	35.0	35.4	35.7	35.8
Molasses % Canes	1.97	2.24	2.34	2.42

REPORTS OF MAGOX IN FACTORY USE

I. HAWAII

Presented here are excerpts from the 1959 Hawaiian Sugar Technologists Proceedings evaluating magnesium oxide at several factories:

Hutchinson Sugar Company - Hutchinson has always been faced with problems in clarification, evaporator capacity, sugar crystal color and in recent years, an increase in production. In continuously experimenting to solve these problems, their objectives were to improve clarification, reduce evaporator tube scaling and improve sugar color and filterability.

In 1958, a trial run of two weeks' operation with 100% MgO showed an increase in turbidity of clarified juice, reduced mud settling causing some fouling of filter screens, which had to be cleaned with acid, and sugar produced was higher in crystal color with a slightly poorer filtration rate. There was no slow down of the evaporators, and a very light scale resulted in the fourth cell which required no manual cleaning after boiling out with caustic soda.

The effect of MgO on evaporator performance was so outstanding that it was decided to try a combination of lime and MgO in different proportions. Mixtures tested ranged from 10 parts lime and 1 to 6 parts MgO by dry weight. A definite pattern was noticed in the effect on turbidity and evaporator scaling. Turbidity increased with high MgO while scaling decreased and vice versa when MgO was decreased.

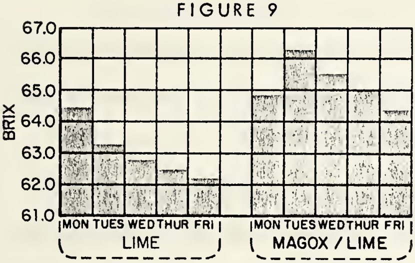
To improve turbidity, various polyelectrolytes and their effect on the types of juice at Hutchinson were tested with assistance from the Hawaiian Sugar Planters Association Experiment Station. Results showed that Seperan AP 30 increased settling rate and improved turbidity. Filter cake was also

improved with no fouling of filter screens. The combination that has been most effective (as of 1959) is 10 parts lime to 3 parts MgO and 2 - 4 ppm AP 30.

The additional cost for MgO and AP 30 can be justified by the following indications:

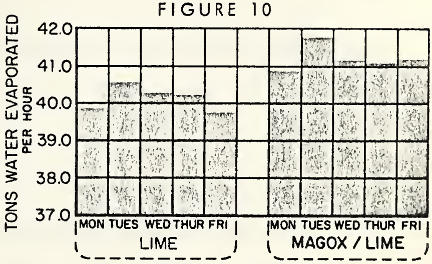
1. Improved and faster clarification.
2. Increase of evaporator capacity as shown in Figures 9 and 10.
3. Reduction of evaporator cleaning cost.
4. Increase of pan capacity with regular syrup densities.

FIGURE 9



Effect of juice treatment on evaporator performance indicated by syrup density

FIGURE 10



Effect of juice treatment on evaporator performance

Olokele Sugar Company - Olokele started using MgO during the 1958 milling season, and has continued usage in every crop since. Main interest in Mgo was the fact that with the use of lime clarification for strike-affected low purity juices, it was found that considerably more lime was required to raise pH to the required level in the juice. Consequently, scaling in the evaporators was more pronounced and difficulty was experienced in evaporating the clarified juice to syrup at a sufficiently fast rate.

Use of MgO solved this problem by almost completely preventing scaling of evaporator heating surfaces. Results were so good, it was decided to continue

the use for juice neutralization and clarification. It was determined that clarification was not the controlling factor regarding the amount of MgO required -- no further improvement in juice clarity was noticed above a syrup pH of 6.1. Raising pH to a satisfactory level to prevent inversion (6.8 - 6.9 syrup pH) determines the amount of MgO required to be added to the juice at Olokele factory.

There was one 13-week period and another 11-week period when the evaporators had no scale cleaning treatment whatsoever. During these periods, the evaporators were not even opened during the week-end factory shut down. This means that the usual total cost of scale cleaning (chemical and mechanical) of $230.00 per week with lime clarification is a direct dollar saving every week that MgO is used. Other observations on the use of MgO at Olokele:

1. No scaling of piping or equipment used for addition of MgO.
2. Slightly more turbid clarified juice than with lime clarification.
3. Less mud volume compared to lime clarification, mud was more difficult to hold on the Oliver Filters.
4. No apparent ill effects on sugar quality or molasses recovery compared to lime clarification.

Grove Farm Company - The Koloa factory started to use MgO in July of 1958, and, apart from some weekly trial tests using lime and dolomite, has been on 100% MgO ever since. As of now, it is planned to continue use of MgO for juice neutralization and clarification for the foreseeable future.

Based on actual results from the 1959 milling season, all of the advantages claimed for MgO have been verified. Slightly more MgO was required at Koloa factory than was first anticipated. The actual 1959 crop

figure was 1.03 lbs. MgO per ton net cane. This is approximately 75% by weight of the amount of lime (1.36 lbs. per ton net cane) than previously used to produce approximately the same syrup pH. It should be noted that much average and strike-affected low purity cane was harvested this year, so this is hardly a fair basis for comparison of the quantity of MgO required compared to lime.

Additional dollar savings were made at Koloa this crop by reducing the strength of the caustic soda spray solution and by completely eliminating all sulphamic acid treatment and mechanical tube cleaning.

When all "visible" cost figures were tabulated, it was found that MgO clarification showed a plus $20.00 saving per week over usual lime clarification costs.

The larger dollar savings were in those advantages difficult to evaluate monetarily:

1. Increase in evaporator capacity and therefore milling capacity.
2. Considerably lessened scaling of pan tubes, syrup samples, syrup valves and piping, etc.
3. Copper heating surfaces in evaporators and pans last much longer because of decrease in caustic or acid corrosion.
4. Higher % of maceration possible on the milling train, and therefore higher % pol extraction.
5. Boiler room and boiling house can be shut down earlier on week ends.

Dolomite analyzing 59.9% CaO and 38.4% MgO was tested for juice clarification. Initially, tests looked encouraging; however, when tried in some of Koloa's bad evaporator scaling fields, the dolomite did not prevent

scaling of evaporators and pans. The mill had to be slowed down and light brix syrup was pumped to the pan floor. The following week, MgO was added to the dolomite solution to decrease the % CaO of the mixture to only 6% -- even this small percentage was sufficient to cause scaling of the evaporators, and consequently, ill effects. A sample of evaporator scale was analyzed and found to be mainly calcium sulfate -- suggesting that MgO clarification prevents evaporator scaling, due to the higher solubility of magnesium sulfate over calcium sulfate.

As of 1965, most Hawaiian factories use varying percentages of Magox, with several using it as a 100% substitute for lime.

II. MAURITIUS AND REUNION.

The following runs were carried out during the latter part of 1964.

Ferney - This factory faced an unusually severe scaling problem because of their use of a sulfur-dioxide/lime system which readily forms calcium sulfate scale. The first use of Magox extended the grinding period from Wednesday morning to Saturday. This had never been possible before at this mill because of the high rate of scale formation. Upon inspection the following Sunday, the evaporator line was clean.

Medine - Utilizing continuous liming at 55°C. with automatic pH control, Magox was used at 42% for 6 days, grinding 19,000 tons of cane. On the last day of the Magox run, maceration percentage on cane was raised to 36%. The evaporators performed satisfactorily and produced 65° Brix syrup. At the inspection after 6 days of operation, the evaporators were found to be clean. A second week's run utilized 30% Magox mixed with lime. This reduction caused slightly dirty evaporators. But over 35,000 metric tons of cane had been milled since the last cleaning. The following week 100% lime was used.

Scale was severe.

Beau Plan - This factory used Magox at the rate of 30% for 3 weeks from August 12th to August 29th. The incrustations were soft and the evaporator was easy to clean. After reverting to lime for an additional week the evaporator was found to be very dirty and very difficult to clean due to very hard scale formation.

St. Antoine - The phospho-defecation process is used on remelted raws of the first massecuite. Magox at 42% was used. Sugar quality was as good as usual, and the evaporator worked very well. The last day of the run imbibition was increased to test the evaporator efficiency, which was found to be good. Incrustations were found to be very soft and there was only a small amount. There was no difficulty in scraping. St. Antoine normally experienced severe scaling with 100% lime.

Mon Loisier - Magox at 42% was run for one week. Upon inspection at the end of this period a gauge was passed through 30 tubes of the last cell. The gauge passed easily, only taking out some muddy water when brought up. It was estimated that the evaporator could have done another week's work. During the shut down over Sunday the drop in purity was only .6% instead of 3% as usual. No significance in molasses purity was noted. Weight of molasses seemed less.

Solitude - Magox was run for two consecutive weeks at 43.8%. Density of syrup was maintained at 1% greater evaporation was obtained for the two weeks. Incrustations were very soft and slight compared to past performance. During the two weeks, the syrup tanks were always empty due to higher concentration. The scaling lessened as the test progressed. Molasses purity remained constant. Weight of molasses showed a slight decrease.

Benares - This factory has two last cells. They use one every alternate day while the other is being cleaned. We started Magox at 40%. After 24 hours the cell was perfectly clean. Magox consumption was reduced to 25% and some scaling formed, but was negligible.

Reunion - Tests currently under way (October 1965) are showing outstanding success. Magox is being used at concentrations from 42% to 50%. After 7 weeks' operation without cleaning, several factories expect to run the entire season without scale forming in the evaporator tubes.

III. PERU

A Basic Chemicals technical representative was assigned to aid in the initial introduction of Magox at the Tuman factory.

Hacienda Tuman at Chiclayo - Scale formation with lime was relatively severe. Evaporator efficiency progressively declined during each 6-day 20,000 ton cane grinding run. Because of these conditions, Magox was introduced at 75-80% of the total liming mixture. Control was firmly established and maintained. The following observations were made 60 hours after Magox introduction and after the entire system had been balanced out with Magox.

CLARIFIER
Juice clarity: excellent
Juice turbidity: excellent
Juice color: slightly darker than with 100% lime
Suspended matter: excellent
Mud: dark, rich, heavy, granular. Working well on filters. Excellent composition of cake.

EVAPORATORS
Producing excellent syrup of good color and of the desired Brix. No increase in pressure or temperature necessary. No additional scale on sight glass of last body. (Prior to the addition of Magox, 7,397 tons of cane were milled and several thousand gallons of water were evaporated for boiler water make-up, thereby causing dirty evaporators.) An additional 9,500 tons of cane had been milled at the time of these observations.

SUGAR QUALITY
All strikes working very well in pans. Grain formation good. Massecuites freeing nicely, producing good color, dry sugar from all strikes.

Eight days after beginning to use Magox, extremely dirty cane entered the factory as a result of heavy rains. Since this condition is so rare here, no provisions are made for washing. Added to this unusual condition was highly turbid river water used for imbibition and chemical mixing. Together, these conditions added an exceptional amount of mud to the clarifier, as well as a high solids load to the entire system. Observations taken after 13,000 tons of this dirty cane had been milled showed perfectly clean evaporators. Records for the first day of dirty cane milling show 3,194 tons of cane milled at the rate of 179.4 tons per hour, evaporator delivering 67.98 Brix syrup with 23.24% imbibition water.

In an attempt to reduce downtime inversion losses in the clarifier, pH of the clarifier was raised to 7.8 four hours before milling was stopped. The slower reaction time of Magox prevented juice pH from dropping lower than 7.3 - 7.4, and losses from low pH inversion were decreased.

IV. JAMAICA

The Magox trials were conducted during the 1964-65 crop.

Magox was introduced to the clarification process at a ratio of 32.68% Magox/lime, without difficulty in mixing slurry to 1.5° Be. The automatic pH control was reset from 8.2 (100% lime) to 7.6, and produced a clarified juice pH of 7.07 average against a control pH of 6.9 - 7.0. Clarified juice was excellent with no significant change in color or turbidity. Comparative data on use of Magox/lime against lime alone are shown in Figure 11 for water evaporated and syrup Brix obtained. Figure 12 shows analysis for final molasses.

Nine thousand five hundred twenty-seven tons cane were ground in this week's run (2,352 tons before Magox), with an over-all evaporation of 6.66 $lbs/ft^2/hour$ calculated from weight of clarified juice. On inspection, tubes in all five vessels showed only a trace of scale in the last effect.

The second trial run started without the usual chemical and mechanical cleaning. Magox substitution was increased to 40% for this run; but due to weather, only 6,805 tons cane were ground. The evaporation rate increased to 7.16 $lbs/ft^2/hour$ for the week; and again, tube cleaning was unnecessary. The condition of Vacuum Pan tubes, although cleaned as normal, had improved considerably and cleaning time was reduced.

The third run was reduced because of bad weather to 4,784 tons cane ground with an evaporation rate of 6.63 $lbs/ft^2/hour$. At the end of this run, the tubes were found to have a light deposit of soft scale which was easily removed by boiling a solution of sodium hydroxide and sodium carbonate in all five vessels. This was followed by a dilute sulphamic acid solution for 2 hours in the last effect. A first-class result was obtained in all vessels. Normally, all vessels required mechanical brushing in addition to the chemical cleaning at the end of each week's run.

FIGURE 11

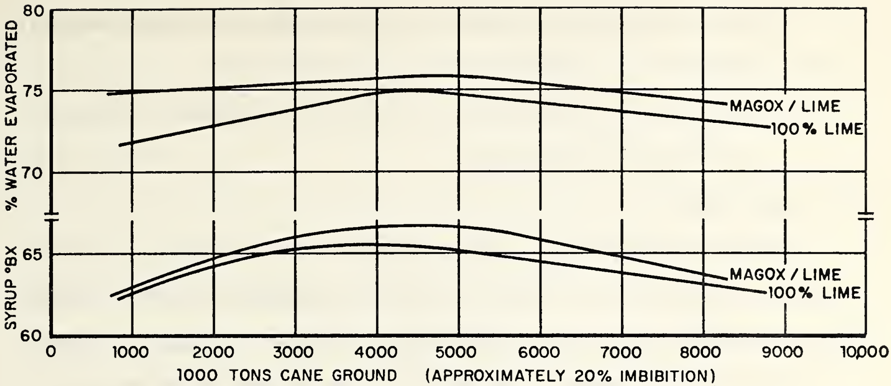


FIGURE 12

Final Molasses	% Ash	% Sucrose	Gals. 88°Bx/TC
Previous 3 weeks (100% lime)	9.10	33.71	6.64
Magox/lime	8.88	32.98	6.36

Sugar ash determination showed a reduction from 0.206% with 100% lime to 0.156% using Magox/lime. (Determination was made by direct incineration.)

These trials have clearly indicated the following areas of savings in boiling house operations:

1. Reduced down-time for cleaning evaporators and vacuum pans, thereby lessening over-all crop time.
2. Labor, chemical and material costs are substantially reduced.
3. Tube life increased.

4. Imbibition rate maintained throughout run.

5. Improved panfloor operation by continuously delivering a high Brix syrup.

6. Improvements in these operations allow for constant or even an increased mill throughput.

V. PUERTO RICO

Historically, Puerto Rico has experienced severe scaling. Based on success in Hawaii, several factories started using Magox in 1960. Results were so dramatic that in 1965, more than 15 centrals use Magox as a necessary operational procedure. Several have found favorable economics in using Magox at 100%.

VI. ANTIGUA

There is only one sugar factory in Antigua, with a harsh scaling problem compounded by extremely hard water. Antigua Sugar Factory Ltd. used Magox in 1964 and reported almost total elimination of scale.

VII. MEXICO

Conclusions from a factory trial.

The use of Magox definitely diminishes the problem of evaporator scale. Although this trial was relatively short, we obtained a considerable savings in cleaning chemicals. In addition, downtime for cleaning was reduced. A reduction in the volume of mud was noticed from the beginning of the trial, permitting greater production efficiency of the filter, and mud was no longer a problem.

Turbidity and color of clarified juice did not improve by use of Magox. Quality of sugar was good. The most economical percentage of Magox and lime must be found, as this varies with each factory, and possibly with each crop.

Experiments with Magox will be continued on the next crop, in order to determine the optimum combination of Magox and lime that will produce a high quality sugar and at the same time eliminate scale from the evaporators.

VIII. FLORIDA

The use of Magox in the clarification process at a major Florida Sugar Factory, was completely satisfactory. The 100% increase in operation of the triple effect evaporators that was obtained during this experiment is a clear indication that in normal conditions, 160 hours or 300% improvement can be easily reached.

IX. LOUISIANA

The following comments were taken from a factory report on their Magox Trial. Analytical data are shown in Figure 13.

1. Juice from clarifiers was clean and had a light amber color.
2. Juice did not have the red color as when using lime alone at 6.3 - 6.4 pH.
3. After a few days of using Magox, sugar was of a lighter color.
4. Mud from clarifiers had more body. The mud was heavier, therefore, there was less mud for the filters.
5. Very little additional lime was added to the mud for the filters. Filters dropped a very nice cake.
6. There is no doubt about the scale being softer on evaporator tubes. The tubes are cleaner after boiling out.
7. If approved, Magox will be used this next grinding.

FIGURE 13

Neutralization	Purity Rise Dilute To Syrup	Sugar				Mud Loss % Cane	Recovery	PH.	
		% Ash	% Invert	Filter-Ability	Pol.			Def. Juice	Syrup
Lime Alone 11/14 - 11/29 31,781.135 Tons	3.56	.406	1.071	61.35	97.10	.208	83.773	6.30	6.07
Lime - Magox 11/30 - 12/2 32,064.810 Tons	3.50	.357	.836	71.90	97.03	.172	85.491	6.38	6.16

WHY CONVERT YOUR CLARIFIER TO A POLY-CELL

Alfred L. Webre, Jr.
Sugarcane Growers' Cooperative
Belle Glades, Florida

This is the history of a clarifier which should be of interest to all sugar houses, whether or not they have sufficient capacity. In December, 1963, we were planning for an expansion to be completed in time for the 1964/65 season. Additional clarifier capacity was on the list. At that time we were approached about the possibility of achieving that capacity by using a Bach Poly-Cell Clarifier instead of a conventional unit. The Poly-Cells had been in use for a number of years in Louisiana for filtrate, but had never been used for whole juice on a continuous basis. After observing a unit at Sterling operate on whole juice for several hours, the writer recommended that we take something of a gamble on a small unit and put it up during the then current crop. If it gave full satisfaction, our expansion would probably be complete in that department; if it fell down we would have time to install a conventional clarifier, and would be out only the price of this small unit. Accordingly, we got the unit on stream in February, 1964, and had about 2 months to play with it before the crop ended.

As installed, the unit let us down badly. When operating with anything resembling the quantity of juice that it should, the mud was so thin as to be intolerable. The suspended solids in mud did not reach 1%. Accordingly, we recommended that additional conventional capacity be provided for our expansion, and this was done.

However, in the midst of the problem of very thin mud, it was obvious

to everyone that the unit had extraordinary capacity for clarifying juice. The juice end would not get upset no matter how much juice was put in it, within the limit of its feed pipe. Furthermore, when operating wide open, the juice was not only clear, but had a purity definitely higher than that of the juice from the conventional units. In fact the results of half a dozen grab samples showed a difference of approximately one point. Accordingly, it was decided that, in addition to putting up the conventional clarifier we should attempt to rectify the thin mud from the Poly-Cell. To do this we simply added mud thickening space by dropping the bottom 5' and re-welding it to its skirt foundation. We also removed various arms which were part of the original design, leaving only a chain to keep the mud from building up on the cone.

The results were everything that we could desire. The clarifying capacity remained unimpaired, while the mud was at least as heavy as that of the conventional units. Since the unit was equipped for experiments, we were able to get a rough idea of what we were putting through it. Given the piping arrangement, etc., when the valves were wide open it was about equivalent to 1200 TCD of cane. This was not its ultimate limit, but merely the maximum that would squeeze through the feed pipe under the existing pressure. And it corresponds to a juice retention time of something comfortably under 2 hours. Compare this with the 4-5 hours in a conventional unit, and you can appreciate the reason for the difference in purity. To confirm this result, we ran brix and pol tests on the overflow from this unit and from the general header of the conventional units once an hour for 2 days. The results showed a difference of 0.98^{o} Purity, in favor of

the Poly-Cell. This confirmation required that we take a hard second look; capacity, or lack of it, no longer was the dominant factor, but -- rather the economics of it played the major role.

In our case, the brix and pol in juices and pol % cane are such that a rise of 1^{o} purity means a savings of 15¢ per ton of cane. With this figure in hand it was immediately expedient for us to start the process of converting our clarification station to the Poly-Cell system since we simply cannot afford to throw away upwards of $150,000 per crop by inversion if it can be avoided. It was therefore decided to convert one of our 22' - 4 tray conventional units, iron out the bugs, and be guided by the results in the next conversion.

The experimental unit has a 12' diameter and is equipped with 36 cone-trees of 25 cones each. Conversations with Mr. Bach led us to decide to put 120 cone-trees of 28 cones each in the conversion, and this was done. The drive and central tube were left in place to move the bottom scraper which was to continue to perform its normal function. All trays were removed and the feed arranged to be distributed to four point 90^{o} apart around the periphery and/or to the center through a Christmas tree around the central tube. Another set of mud pumps was added, for a total of four units, all pumping, naturally, from the center of the bottom cone.

Both the experimental unit, which we call the "Bachito," and the converted unit, which we call the "Bachon," worked the whole of the 1965/66 crop and did yeoman's service, taking an estimated 60% of our total juice between the two. However, it was obvious from the beginning

that the Bachon was not keeping up proportionately with the Bachito, which is prodigious. Some minor changes we made during the crop, others will be incorporated in the next conversion. Although the Bachon was not designed with research in mind, one develops ways of estimating figures; in the first month or so of the crop we determined that the unit could readily handle up to 3500 TCD of cane, but the thickness of the mud left much to be desired. To correct this, the first step was to speed up the revolutions of the scraper. This had been rotating a revolution in 5 minutes; in our warehouse we found a sprocket which speeded this up to 2 minutes, 10 seconds. The difference was notable, and the mud thickened up to about the same as that of the conventional units though the amount of juice was more than double. During the early part of the crop we operated with peripheral feed only. Periodic attempts to put part of the feed in the center were plagued by extraneous problems, but finally, about 2/3 of the way through the crop, we succeeded in putting all the feed to the center, with another improvement which put the thickness of the mud somewhere between that of the Bachito and the conventional unit.

Again we examined the purities, but this time on a basis of true purities and including analyses for inverts. Naturally, without a research department, we had to be satisfied with what our regular lab crew could do in their "spare" time, and so limited ourselves to simultaneous grab samples from each type of clarifier once a day for four days. Again, the purities confirmed what we had previously determined. Further, although a true material balance was virtually impossible, our figures indicated a destruction of glucose in the Poly-Cell amounting to about 1%, while the juice from the conventional unit showed several times that amount.

As an interesting side light we also noted the following in regard to pH and the consumption of lime. In Florida, probably because of the high nitrogen content of the soil and hence ammonia in the juice, we normally have a pH drop through conventional clarifiers of one full point. This means that we have to lime the raw juice to about 7.9 pH in order to have the clarified juice at the usual 6.8 - 7.0. Now, through the Poly-Cell units, again probably because of the low retention time, the drop is only half as much. This means a reduction in the consumption of lime; it does not necessarily mean a reduction in evaporator scaling since it is probable that all excess lime goes out with the mud, regardless of the pH to which one adds lime. This point remains to be checked when we are operating totally with the Poly-Cell system and can take full advantage of the lower initial pH. We have posed this question to a number of competent chemists, but none would give a firm answer. Incidentally, when operating as we have been, with part of the juice going to Poly-Cell and part to conventional units, both types operate at a disadvantage as one has to compromise with the pH. The result is a pH higher than optimum for the Poly-Cells and lower than normal for the conventional units.

As indicated above, the Bachon operated very well, with capacity at least double its pre-conversion figure. But it could handle still more if we could induce it to deliver heavier muds, that is, accelerate the mud-thickening process. Now, the steep cone of the Poly-Cell performs a very important function as a thickener which can be readily demonstrated with two test tubes. Fill both with clarifier feed juice, then hold one vertical and the other at 45-60° for one minute. The difference is extraordinary. I do not pretend to know the explanation, but the mud

separates and compacts much more rapidly with the steep angle than with the vertical. We are convinced that in converting a conventional clarifier, some effort must be made to simulate the steep cone of the Poly-Cell. Therefore, in our next conversion the first step after removal of the tray and the scrapers will be to suspend a cone whose major diameter is perhaps 85-90% of the diameter of the clarifier itself. This will leave only a relatively small part of the mud to fall vertically to the bottom and be pulled into the center by the scraper. Another important factor is to have sufficient mud retention time. To achieve this, we have reached the conclusion that the volume available for mud be at least 1.8 times the volume above the mud level. To achieve this in a conversion, it will usually be necessary to limit the number of cones to 20 per tree, instead of the 28 that we put in our first conversion. This is a reduction of almost 29%, but we believe that overall we will have more juice-handling capacity since the bottleneck presently is in the mud-handling capacity which reflects back to the juice-handling.

One important feature about clarification station which consists of both Poly-Cell units and conventional units is that a proper splitter box is essential. The reason is that if you do not have one, whenever the clarification becomes difficult the operator, using the juice clarity as the only criterion, will pass more and more juice away from the conventional units and into the Poly-Cell. Eventually they will reach a point where the mud from the Poly-Cell is too thin for the filters and a great commotion will start, ending up in inferior work at the clarification station and a bad reputation for the Poly-Cell.

In resume, please note the following:

1. Conversion, using the Florida wage scale, of a conventional clarifier to a Poly-Cell should cost under $8 per ton of juice handled per day, but this will vary according to the amount of re-arrangement that must be done.
2. The direct advantage because of high capacity and low retention time is about 15¢ per ton of cane ground.
3. Additional benefits rebound from the rapidity with which the clarification station can start delivering clear juice to the evaporators after start-up.
4. Since the clarifiers can be liquidated in under two hours if they have adequate liquidation pumps, it will be economic to liquidate them every time there is a shut-down in excess of 6 hours.

BANQUET ADDRESS

by
Dr. George P. Meade,
Retired Sugar Refiner, New Orleans, Louisiana

ASSCT 1965

It is an especially pleasant privilege and honor for me to address you this evening because this is the second occasion on which you have invited me to be your speaker. Possible this second invitation, after a lapse of some twelve years, came because none of the present program committee remembers what I said on my previous appearance before this Association.

In casting about in my mind for a topic for my talk tonight, the subject of sampling (a most important phase of sugar analysis) came to mind, but I decided that this would be too technical for such an occasion. However, I do have a story about sampling which I will relate before I go on with the rest of the talk.

For the benefit of the ladies, let me explain that a "grab" sample is just what the name implies. You want to sample a pile of sugar or a tank of liquor that you know is well mixed so you grab a handful or a cupful as the case may be.

The public opinion polls are grab samples in a sense, and experience has shown that the results are excellent, but the method has its pitfalls as my story will show. Somebody (never mind who or why) wanted to find out the average height of adult males in New Orleans so he decided on the "Grab Sample" method. He posted two men on Canal Street, one in front of Godchaux's Store on the uptown side, the other in front of Maison Blanche

on the downtown side. The plan was that at exactly 1:25 P.M. to the second on their synchronized watches, each of these men would corral, or lassoo, any ten men passing the store at that particular instant. The man on the uptown side caught his ten men, explained what he wanted, and measured each man to the closest quarter of an inch. His average showed 4 ft. 7¼ inches. He had roped a group of singer midgets on the way to the shrine circus. The man on the downtown side carried out his assignment to find that <u>his</u> ten averaged 6 ft. 8½ inches. His group was the University of Kentucky Basket Ball Squad. The results of the experiment delighted the inventor of the scheme, because the average of the twenty men was 5 ft. 8 5/8 inches which later proved to be exactly the average height of New Orleans men! Of course, no member of this organization would perpetrate such a monstrosity as this kind of sampling, but I've seen some almost as bad in my day. So much for sampling. When a man has talked as much and written as much as I have, he runs the danger of repeating himself in such a talk as this. I am wilfully chosing a topic that I discussed at another organization meeting a number of years ago, but I hope that the treatment will appear sufficiently different so that I do not sound like a phonograph record in which the needle is stuck. We hear all the time in speeches and in sermons that we are living in the greatest age that man has ever known and that the changes of the last two decades have revolutionized the world. Nuclear Fission, Space Exploration, Digital Computers, Electronic Automation -- these are all wonders far beyond my ken. We can listen to a man's heart beat in a space capsule travelling in orbit at 17,000 miles an hour, but we do not know how to regulate the traffic on Canal Street at five o'clock in the afternoon. We have computers that can play a game of chess or calculate

"PI" to 2,000 decimal places in a few hours or even minutes, but the common cold still baffles the medical profession.

My argument tonight is that these developments since World War II, marvelous beyond all imagining, have not affected your life and mine the way that many of the inventions which came out during my school days, have done. Who among us has ever seen a space ship, much less ridden in one? Computers are something for a Research Laboratory or at least something we never use personally. Electronic devices remain hidden from our view. Nuclear fission is a specter to scare us into nightmares, though a real horror still to the people of Japan. As opposed to these modern marvels, try to imagine a world without automobiles, or motion pictures, or the airplane, or wireless communication, or recorded sound. These, and many other facets of our everyday life, were the development of the ten or twelve years around the turn of the century when I was in grade school, high school and college. These years, say roughly between 1895 and 1905, were to my mind the greatest that the world has seen so far as the life of all of us is concerned. I will talk briefly of my own experiences in the unfolding of these present-day commonplaces.

Someone is sure to say, here we have an old gaffer recalling the "good old days." Not so. In many ways they were far from good. The life expectancy of a child born in my early days was 43 years; today it's over 70 years. One person in every seven died of tuberculosis, and one in twelve of typhoid fever. Both of these preventable diseases have ceased to figure prominently in the death-listings today. Vitamins were unheard of until about 1920. People died of, or were crippled by, pellagra, scurvy, ricketts, and beriberi. No one even guessed that these dreadful diseases were not

caused by something, but by the lack of something. But enough of the "bad old days." Let me tell of some of the great things that happened.

The automobile possibly ranks first. The first automobile that I ever saw was such a curiosity that it headed a circus parade! In 1895, Barnum and Bailey hired the Duryea Brothers (who claimed patents as the "Inventors" of the automobile) to appear in their street parade and in the "Grand Opening" of the afternoon and evening performances. As a twelve-year old in Oswego, New York, I watched that little open buggy, carrying the bearded Duryea Brothers, replete in the inevitable derby hats, puff along at the head of the outdoor procession. That car, with outside chain drive and a tiller instead of a steering wheel, probably weighed less than a present day motorscooter. The Duryeas called it a "Buggyant." The top speed was less than 20 miles an hour, but it could do what a horse-drawn vehicle could not do -- back up gracefully. The "Buggyant" would back up frequently when it gained on the slower-moving horse-drawn bandwagon. This maneuver invariably brought forth loud cheers from the crowd. This hard-tired, high-wheeled car appears comic to us today but it was the prototype of the juggernauts that clog our highways today.

Moving pictures came into being at about this same time. Strangely enough, motion pictures -- the word "movie" came in much later -- started in rather sleazy or questionable form. The first public performance was in New York in 1896, but soon, all over the country, promoters hired vacant stores, set up a machine at one end and a sheet stretched on a wooden frame at the other to show marvels of recorded motion. Biograph, Vitascope, Kinetoscope, were the long forgotten names of the machines but

the show-places soon acquired the name "Nickelodeon" on account of the price of admission. Frequently located in the poorer parts of town, the Nickelodeon acquired an aura of cheapness and doubtful morality, although the pictures shown were innocuous enough. Motion -- live motion -- was the main thing, and the subjects were what we today would call "short shorts." "The Black Diamond Express" showing the D.L.& W. crack passenger train rushing head on at the audience was one favorite I remember. "The Buffalo Horse Fair" with prancing work-horses parading past was another. Waves crashing on the beach gave the audience the effect of being inundated at any minute. The first "Documentary" that I saw was the Corbett-Fitzimmons Fight in 1897, in which Fitzimmons beat Corbett in the sixth round by the famous "Solar Plexus" blow -- a term that stayed in the language for many years to mean any lethal blow, or sneak punch.

Many years elapsed before the so-called "Feature Films" of today developed. One, two, or three reel films were advertised, and the film footage in a picture was a matter of real interest. In Cuba the local cinema used to have streamers giving the figures for its current show -- "Diez Mil Pies" for example. A visitor came back to our house after a saunter up the main street of Cardenas and asked querulously, "What the hell do they mean by advertising ten thousand pies?"

A corollary of the moving picture explosion was instantaneous photograph. The old photographs of our grandparents look stilted and glum because the glass plates of those days required an exposure of several seconds or even a minute and the subject head was held still by an iron clamp of the type now used in dentists' chairs.

Recorded sound became a reality during the same years in question.

We who have magnetic tapes, stereo recorders, and a host of other methods can hardly realize that less than three quarters of a century ago an uttered sound was gone forever. The phonograph invented by Edison and several others, became a commercial possibility about 1895. I remember going to a "lecture" in a church auditorium in Oswego where the speaker demonstrated the wonders of sound recording by playing records of cats fighting on a back fence, a baby crying, the noise of a crowd at a baseball game. Just as the early motion pictures merely showed things in motion, the first phonograph records were of any kind of sound. It should be remembered that the recording was purely mechanical -- a vibrating needle scratching a groove in a wax cylinder -- and that the reproduction used the same equipment in reverse to reproduce the sound.

As the climax of that first program that I heard, the audience sang "My Country Tis of Thee" and the machine then played the rendition back, much to our astonishment. That involved, not only recorded sound, but amplified sound, something that is now so commonplace that we forget we once lacked it. Loud speakers, public address systems, bull horns, and all sorts of electronic gadgets now give us sound in any volume that we may wish (or don't wish). In that distant day, and well into the present century, speakers, politicians, preachers, actors, and all announcers had no help but their own lung power. The art of projecting the voice was a real art. I remember a famous professional announcer, Charlie Harvey, in Berkeley Field in New York on Decoration Day in 1902. With no help whatever, not even a megaphone, he stood in the middle of that quarter-mile track and announced that Arthur Diffey, of Georgetown University, had just broken the worldrecord for the 100-yard dash. Everyone in the stands on

both sides of the field heard every word including the time, 9-3/5 seconds. (Tenth second stop watches weren't allowed until twenty-five years later.)

In the first few years of the century came two inventions that have greatly affected our daily life, mechanical flight and the sending of electrical impulses through space. The first time I ever saw a man in controlled flight was from the window of the laboratory of the New York Sugar Refinery in 1903 where I was a laboratory assistant that summer. A young man named Roy Lillicathal had announced that, weather permitting, he would fly his "Airship" ("Dirigible" came later) over Central Park, New York. His cigarshaped balloon measured less than thirty feet and he was plainly visible to me and to millions of others in New York City as he managed his contraption, with its small motor driven propeller. He walked back and forth on the frail cat-walk suspended under the balloon, shifting his weight back and fourth, depending on whether he wished to go up or down. The rudder, made of a bamboo frame covered with cloth, was controlled by tiller ropes alongside of the catwalk.

That same year the Wright Brothers demonstrated that heaver-than-air machines could be flown. In 1909, I helped push Glenn Curtis' airplane out of its shed (hangars came later) for his first attempt at a New York to Albany flight. I believe weather stopped him that time, but I had a chance to see the bamboo frame, the oiled silk wings, the piano-wire braces and controls, of the airplanes of that day. A far cry from the all-metal multi-ton "flying box cars" of today but the forerunner, nevertheless.

Wireless transmission of electric signals, out of which has come radio, television, and singing commercials, had its real commercial birth when

Marconi proved in 1902 that he could send messages across the Atlantic. At New York University we had a brilliant experimenter who was Professor of Physics, Dr. Daniel Hering, affectionately called "Danny, the Fish." Using equipment that he made himself, Dr. Hering sent telegraphic signals across the heads of his classroom during one of our freshman sessions in Physics. The idea was so startling that, freshman-like, we threw our caps up in the air to see whether we could interrupt these mysterious, and unbelievable, waves. This may have marked the first public demonstration of wirely in New York City. The New York Tribune, of which my oldest brother was then Night City Editor, ran a news item about this news-worthy occurrence.

Someone is sure to say "Can you match the discovery of antibiotics and other miracle drugs in this golden age of yours." My answer is the x-ray, discovered by Roentgen in 1895. The fact that a form of radiation could pass through solid substances marked one of the greatest advances in the history of science. Possibly no one in this room has not benefited in one way or another by the x-ray. The related discovery of radioactivity of various substances by Becquerel and others that same year, completely revolutionized the science of Physics, culminating in 1898 by the MME Curie's discovery of radium.

SUMMARY, ANNUAL MEETING

AMERICAN SOCIETY OF SUGARCANE TECHNOLOGISTS

February 3, 1966

The Annual Meeting of the American Society of Sugarcane Technologists was held at the Lakeshore Motor Hotel, Baton Rouge, Louisiana, on Thursday, February 3, 1966.

The meeting was called to order by President W. S. Chadwick at 10:00 A.M. Mr. Chadwick welcomed the group and expressed appreciation to the nearly 300 members who were in attendance. He announced a business session for 1:45 P.M., notified members to purchase banquet tickets by noon and invited the ladies to attend.

Mr. Irving Legendre, Jr., Chairman of the Manufacturing Section, was presented and in turn presided for the following program:

1. "A New Concept for Main Cane Carrier Drives" by Mr. W. H. Johnston, F. N. Johnston Co., New Orleans, Louisiana.
2. "A Progress Report on the Filtration on Raw and Limed Cane Juice Using the Hayward Filter" by Mr. J. M. Kinebrew, Jr., Standard Supply Co., New Orleans, Louisiana.
3. "A Film on Cane Handling in Louisiana During the 1965 Harvest", moderated by Denver T. Loupe, LSU Cooperative Extension Service.

The morning session adjourned at 11:35 A.M. to be re-convened at 1:45 P.M.

A business session followed lunch and the following items were acted upon:

1. Financial statement distributed and discussed by the Secretary-Treasurer. Approved as distributed.

2. A moment of silent prayer was observed in memory of Howard Thibodaux and Frank Mollan, Society members who had passed away during 1965.

3. Announced that by chair count, 273 members attended the morning session. Different people came in for the afternoon program, but the number was approximately the same.

President Chadwick presented Mr. Kermit Coulon, Chairman of the Agricultural Section who presented the following program:

1. "A Review and Discussion of Some Recent Changes in Cane Handling" by Mr. Nelson Fairbanks, American Sugarcane League.
2. "Status of Mechanical Sugarcane Planter Developments" by Mr. Mansel Mayeaux, LSU Agricultural Engineering Department.
3. "Some Effects of Hurricane Betsy on Sugarcane Yields in 1965" by Mr. Lester Davidson and Dr. James Irvine, U.S.D.A. Sugarcane Field Station, Houma, Louisiana.

This session was adjourned until time for the Banquet.

The Banquet got underway at 6:55 P.M. in the State Room with 168 people attending. Invocation was given by Mr. Clay Terry. Following the meal, President Chadwick presented the out-going officers, thanking them for their efforts in making his term of office as President most successful. Past-Presidents,who were seated at a special table, were also recognized.

Dr. George P. Meade, retired sugar refiner, was introduced and delivered a most interesting talk. (Copy will be in the Proceedings.)

Mr. Chadwick then presented President-Elect Paul Cancienne who in turn presented the 1966 Officers:

1st Vice President - Thomas Allen

2nd Vice President - Clay Terry

Secretary-Treasurer - Denver T. Loupe

Chairman, Agricultural Section - John Wm. Barker

Chairman, Manufacturing Section - J. A. "Pete" Dornier

Chairman-At-Large - Warren Harang, Jr.

President Cancienne accepted the chair from Mr. Chadwick and pledged his efforts, with the cooperation of the other officers, toward a successful year for the Society.

Respectively submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

SUMMARY, SUMMER MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

June 2, 1966

The Summer Meeting of the American Society of Sugar Cane Technologists was held on Thursday, June 2, 1966, at Francis T. Nicholls State College, Thibodaux, Louisiana.

The meeting was called to order by President Paul Cancienne. He acknowledged the fine attendance, recognized those responsible for arrangements, and called on Dean Vacarro for remarks of welcome.

President Cancienne then presented J. A. "Pete" Dornier, Chairman of the Manufacturing Committee, who in turn presented the following program:

"Why Convert Your Clarifer to a Poly-Cell," by Alfred L. Webre, Jr., Sugarcane Growers Cooperative, Belle Glades, Florida.

"The Silver Ring Diffusion System," by Jay Dornier, Silver Engineering Works.

"Magnesium Oxide for Preventing Evaporator Scaling," by Derek J. Twigg, Basic Chemicals. (Presented by Mr. Hoffman and Mr. Smith)

Following a few announcements, the meeting adjourned for coffee.

A brief business session was called. The only business to come up was the authorization of monies to help defray expenses for sugarcane parish agents who were planning to attend the Annual Meeting of County Agricultural Agents in Hawaii. Motion made by Clay Terry was seconded by Lloyd Lauden and unanimously adopted.

Following this brief business session, President Cancienne presented John Wm. Barker, Chairman of the Agricultural Section, for their program

which was as follows:

"Minimum Tillage and Cultural Practices," Lloyd Lauden, Agronomist, American Sugarcane League, Moderator of Panel. Participants: Rouby J. Matherne, Agronomist; Lester Davidson, Chemist, U.S.D.A. Sugarcane Field Station, Houma, Louisiana; Douglas Stevens, Cinclare Sugars.

The program being completed, the group adjourned to the American Legion Building for lunch.

Respectively submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 14 - Papers for 1967

December, 1967

FOREWARD

This is the fourteenth volume of proceedings of the Society which has been published since its founding in 1938.

The first volume, published in 1941, included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume, published in 1946, included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer, edited that edition.

The third volume, published in 1953, included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years of 1950 through 1953. Volume five contains papers for the years of 1954 and 1955. The sixth volume included papers presented during 1956. The third through the sixth volumes were edited by Dr. Arthur G. Keller.

The seventh volume, which is in two parts, 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth through the thirteenth volumes contain papers presented during 1961 through 1966, respectively. These volumes, as well as this, the fourteenth volume, which includes papers for the year 1967, have been compiled by the writer.

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

December, 1967

TABLE OF CONTENTS

GROWING SOYBEANS FOR GRAIN IN THE SUGARCANE BELT

Lowell L. McCormick
Specialist (Agronomy)
L.S.U. Cooperative Extension Service

Growing soybeans is not a new practice in the cane area. For many years they were grown for soil building just prior to planting cane. However, the production of soybeans for oil requires completely different practices. The following discussion pertains to soybeans produced to be harvested for grain.

Numerous factors contribute to soybean yields. A brief discussion of several of the factors will follow.

1. Land Selection.

Ideally, land for soybeans, as for other crops, should be fertile and well drained. A majority of the land in the cane belt is fertile and can be adequately drained to grow soybeans. Sandy loam and silt loam soils are usually preferred for most crops because they are easier to work. However, soybeans produce high yields in mixed and heavy soils. Some 75 percent of the acreage in the alluvial soils is planted on these mixed to heavy soils.

2. Soil and Water Management

Soybean plants require large amounts of water, especially after pollination, to produce high yields. However, as with other crops, good surface drainage is necessary to permit seedbed preparation as scheduled and for planting to be accomplished at the best time. Good drainage and "pothole filling" will permit better weed control because of more timely cultivations. Harvesting efficiency also will improve because the operator can get in the field with a minimum of delay after rains.

3. <u>Lime and Fertilizer Requirements</u>

Soybeans require moderate amounts of fertilizer, but the plants seem to be excellent scavengers and are able to efficiently utilize fertilizer elements in the soil.

Soybeans, being a legume crop, require large amounts of calcium and pH approaching 6.0 for best results. There are certain high organic or "muck" soils near the coast where applications of lime necessary to raise the pH to near 6.0 probably will not be economically feasible for soybean production. The answer to this question probably will have to be answered by grower experiences and observations. Be sure to soil test any new land or other land going into soybeans that has not been tested within the past five years.

In general, alluvial soils or soils along the various rivers and bayous contain adequate phosphorus and potassium for soybeans. Still, to be certain, test the soil and follow recommendations. Soybean plants will produce their nitrogen when the other elements are provided.

In certain experiments in Louisiana and other Delta states, molybdenum, a micronutrient, has given some increase in yield if the pH was between pH 5.2 and 5.7 and the calcium level less than 1000 ppm. When soil conditions were different from these, there was no increase in yields from the addition of molybdenum. This element is applied to the seed just prior to planting and strictly according to directions on the container.

4. <u>Seedbed Preparation</u>.

A good seedbed is free of large debris, firm but not hard, and contains adequate moisture to germinate the crop seed. Some benefits from a well-prepared seedbed are: (a) improved seed germination, (b) improved

stand, (c) better plant growth through good root development, and (d) better weed control.

To have moisture at planting time, if soybeans are to be planted in rows, the beds should be made in late winter or early spring. These beds can be made with either middle breakers or "hipping ridgers." To control weeds on these beds, the rows may be reversed or the tops and the sides of the beds may be cultivated with the ridger.

If the soybeans are to be planted flat in narrow rows or broadcast, the land can be worked until planting time.

5. Variety Selection.

The selection of an adapted variety or varieties is an important factor in your production program. Most soybean varieties mature at a definite time, regardless of planting date. Therefore, to lengthen the harvest season, more than one variety should be planted if acreage exceeds 200 acres or possibly even less. Limited research and observations indicate that most varieties planted in other parts of the state can also be planted in the cane belt. The following table lists the varieties presently planted in Louisiana.

CHARACTERISTICS OF CERTAIN SOYBEAN VARIETIES GROWN IN LOUISIANA

Variety	Height Inches	Approximate maturity date	Resistance to foliage diseases	Flower color	Eye or hilum	Pod color
Hill	28-32	Sept. 18-23	Good	white	brown	tan
Dortchsoy 67	28-32	Sept. 25-30	Good	white	brown	gray
Hood	28-32	Oct. 7-12	Good	purple	buff	gray
Curtis	28-32	Oct. 12-18	Good	purple	brown	gray
Lee	28-32	Oct. 17-23	Good	purple	black	brown
Bragg	46-50	Oct. 22-27	Good	white	black	brown
Bossier	36-40	Oct. 24-30	Good	purple	brown	brown
Jackson	46-50	Oct. 24-30	Fair	white	buff	gray
Bienville	44-48	Oct. 26-31	Good	purple	brown	brown
Hampton	42-46	Oct. 27-Nov. 2	Good	purple	brown	brown

All soybean seed in the above table are yellow in color.

From prior observations, satisfactory to good production has been obtained from the Hill, Hood, Lee, Curtis, Bossier, Bragg, Hamptom and Bienville varieties. More information should be available for the 1968 crop.

6. Seed Quality

A good stand must be obtained to make profitable soybean yields. Planting certified or other high quality seed of known varietal purity and known germination will go a long way in assuring a stand that will produce high yields. Certified seed also insures the planting of a minimum amount of noxious weed seed. Never plant soybean seed unless you know the variety, percent of germination and that they have been cleaned to remove trash, weed seed and other foreign material as well as splits and other damages.

Poor quality seed may also be affected by disease organisms. If it should become necessary to plant seed having low germination, treat them with a fungicide. Varieties now grown in Louisiana are resistant to most common soybean diseases that occur in the soil. There may be minor outbreaks of *Rhizoctonia* and southern blight, but at present there are no satisfactory methods of control.

7. Inoculation

It is essential that the proper nitrogen-fixing bacteria be present in the soil if satisfactory yields of soybeans are to be obtained without the use of commercial nitrogen. Most soils contain some of these bacteria, but to assure rapid nodulation, always apply the bacteria inoculant on seed planted on first-year soybean land. Use precautions to keep the inoculant-treated seed from direct sunlight for extended periods of time. If molybdenum and/or a fungicide is applied to soybean seed, apply the inoculant last and just prior to planting. It is wise to continue to use inoculant for at least the first two years soybeans are planted and it may be used each time thereafter.

8. Row Spacing

Soybeans can be expected to grow taller in the cane belt than in other areas of the state when planted in the recommended period of time. Closer row spacing or higher plant population often causes taller plants. This, in turn, causes increased lodging or falling over.

Research to date on fertile soils in Louisiana indicates no advantage to planting rows closer than 30 inches apart. Soybeans may be planted without loss of yield in rows up to 42 inches apart. Soybeans definitely should not be planted on normal width cane rows. The existing equipment can best be utilized by making two planting rows from each cane row. This gives soybean rows of 34 to 36 inches apart, which will give adequate plants for maximum yields and will permit cultivation for controlling weeds.

Soybeans can be drilled in narrow rows or planted broadcast on land that is flat. These methods of planting are more risky than normal rows unless there is good drainage and unless weeds can be controlled without cultivation. At present, there are numerous weeds in the cane belt that are not being satisfactorily controlled with herbicides.

9. Rate and Date of Planting

Plant seed having a germination of 80 percent or better at the rate of one seed per inch of drill in the row on 30 to 42-inch rows. It is often necessary now to plant soybeans with less than 80 percent germination. Allowing for the variation in row width and seed size, the normal seeding rate ranges from 45 to 60 pounds per acre. Seeding rates for narrow rows or broadcast plantings range from 90 to 120 pounds per acre. Seeding at rates significantly greater than previously mentioned may result in greater lodging, decreased combine efficiency and poor seed quality.

Tests have shown the optimum planting period to be from May 1 to June 15. There are plantings in the area that indicate the Hill variety may be planted slightly earlier than May 1. Creditable yields may be obtained by planting earlier or later than May 1 to June 15. It is risky to plant before April 15 and after July 15. Yields from planting outside the optimum period are reduced primarily because the plants will not get tall enough and the pods will set too close to the ground. When planting in July, always select a variety that normally matures in late October or early November (see varieties).

10. Weed Control

Maximum yields can be obtained only by controlling weeds early to prevent them from competing with soybeans for moisture, plant nutrients, light and space.

Weeds are controlled by preplant, preemergence and postemergence methods.

Preplant - This method is used to control established Johnsongrass by fallow plowing in the spring or by spraying with Dowpon followed by plowing. Some control of all weeds can be obtained by delaying planting to allow the use of shallow plowing to kill several crops of annual weeds.

Preemergence - These chemicals are applied before planting or immediately after planting to keep grasses and broadleaf weeds from emerging. Such herbicides as Vernam, Treflan or Planavin are normally applied and incorporated or mixed in the soil before soybeans are planted. Other herbicides such as Amiben, Lorox and Dacthal are applied on the soil surface immediately after plantings. These surface-applied herbicides must have rainfall within about 10 days after application to be effective in controlling weeds. Contact your county agent for a leaflet

entitled, "Preemergence Weed Control in Soybeans," for details on weeds each herbicide will control and rates to apply on different types of soil.

Postemergence - This method of control is used when both the soybeans and weeds are up and growing. Both mechanical (cultivation and hoeing) and chemical means are used at this time. Small, broadleaf weeds such as pigweed, cocklebur, tievines and tall indigo can be effectively controlled with Tenoran plus surfactant. Tievines also can be controlled by flame cultivation after the beans are 12 inches tall. Large cockleburs can be fairly well controlled with 4(2,4-DB), a compound similar to 2,4-D and tall indigo can be controlled by wax bars. Additional herbicides are needed in soybean weed control, but those available are not being utilized to their full potential. Contact your county agent for a leaflet entitled, "Control Weeds in Soybeans with Postemergence Chemicals," for specific rates.

11. <u>Insect Control</u>

Insects can rob you of your profits from soybeans. Those insects that attack beans are separated into two broad groups - leaf feeders and pod feeders.

Leaf-feeding insects such as green clover worms, velvet bean caterpillars and loopers feed on leaves only. These insects do not usually require control measures until the beans bloom or later. Control measures are necessary when 25 to 30 percent of the leaf area has been destroyed.

Pod-feeding insects begin feeding on young beans immediately after they are formed. Stink bugs feed on seed in the pods from the time the seed are formed until they are almost mature. These insects reduce yield by reducing seed size, and stink bug-punctured seed are considered

damaged and are discounted in price exactly the same as decayed seed.

Bollworms (corn earworms) also feed on beans by eating away the pod and feeding on the seed. These insects can be extremely harmful because a single bollworm can breed on several plants.

An insect that can feed on both foliage and pods is the bean leaf beetle. Prior to 1966, bean leaf beetles had been only injurious to soybean foliage. However, in some sections of Louisiana it was discovered that these beetles were causing damage to pods very similar to that of bollworms.

Before considering control measures, the grower should decide to check his fields for insects or hire someone to check at least weekly. Learn to identify the various insects. Different insects require different control measures. Don't use insecticides until the infestation is high enough to require control. Do not guess because you may worsen the situation. Finally, use only recommended insecticides. Methyl Parathion and Sevin are the only two insecticides recommended for use on soybeans in Louisiana. Consult your county agent for the latest insect control guide and method of determining insect infestation.

12. Harvesting

In a survey conducted last fall, it was found that 5 to 7 bushels per acre of soybeans were left in many fields. The two main causes of loss were shattering that occurs before the beans get into the combine and pods left on stalks that were cut too high above the ground.

Losses from shattering can be reduced by starting the combine when soybean moisture is at the 15 to 16 percent level and by proper reel speed, cylinder speed, ground speed and concave adjustments. Field losses due to height of cut can be reduced by automatic devices to

control the header and by using only well-trained combine operators.

13. Storage and Marketing

Soybeans may be sold directly at harvest, sold on contract for future delivery or stored either on the farm or in commercial facilities.

Elevators are rather scarce in the cane belt, therefore, you may not have much of a choice as to who will buy your beans. Shop around to see where you can get the best price. Remember, soybeans are bought and sold on quality and you should become familiar with grade factors and discounts as they affect price.

Soybeans are supported by the CCC at a level of approximately $2.50 per bushel for No. 2 quality beans. However, approval for storage must be obtained from the ASCS. There is no guaranteed price of $2.50 per bushel when beans are sold at the local elevator. You will just have to take the best price you can get.

If you are interested in on-the-farm storage, consult reputable dealers or ask assistance from the Cooperative Extension Service and the ASCS. Both of these organizations can provide information that may save you money in the long run.

For information on contract buying for future delivery, consult a representative of a commodity broker or the marketing specialist of the Cooperative Extension Service. It is most important that you understand your obligations when making the contract.

Producing soybeans for grain is fairly new in the cane belt. However, based on observations in 1965 and 1966, this crop offers you another profitable enterprise for your farming operation.

EFFECTS OF AN EARLY FREEZE ON LOUISIANA SUGARCANE

James E. Irvine
Plant Physiologist
U.S. Sugarcane Field Station
Houma, Louisiana

Sugarcane growers in the continental United States have always faced the possibility of an early freeze. On Dec. 11, 1934, Clewiston, Florida, experienced a record 21°F. Cane stalks showed varying degrees of tissue damage. In spite of predictions that sugar house operations would cease between 10 to 30 days following the freeze, the crop was still producing sugar 75 days later (Bourne, 1935). Although severe late freezes can cause a drop in sugar recovery in one to two weeks (Irvine, 1963, 1966), early freezes are usually more moderate. Minimums of 28°F on Oct. 30, 1951 and 29°F on Nov. 3, 1951 were record low temperatures for those dates. In experimental plots with 50% terminal bud and leaf injury, periodic sampling showed little decline in cane quality one month after the 1951 freeze (Coleman, 1952). A similar study following the 1952 freeze showed an improvement in cane quality. C.P. 44-101 increased 2.43% in sucrose and 7.5% in purity during the 40 days following the freeze (Coleman, 1953).

On Nov. 2, 1966, a strong Canadian high pressure area lowered the temperature at the Houma Station to 32°F by 11:00 PM and by 6:00 AM the following morning (Nov. 3) a minimum of 24°F was reached. Below freezing temperatures lasted for 9 hours and the minimum temperature lasted for 45 minutes. This freeze was the most severe recorded for early November, and similar temperatures (23 to 26°F) were reported throughout the sugar belt.

While previous early freezes caused 50% leaf and terminal bud injury, the damage caused by the 1966 freeze was more extensive. Most fields of standing cane were completely brown several days after the freeze. No undamaged terminal buds were found in commercial fields. Damage to lateral buds varied from 10 to 100%. Stalk damage was widespread with at least 1 or 2 internodes below the terminal bud showing frozen tissue. In some localities frozen stalk tissue extended completely to the ground.

Growers were dismayed at the extensive damage caused by the freeze. When the leaves turned completely brown they realized that the 12-13% sucrose recoveries would be the best that could be expected. Those with planting still to do were reluctant to plant cane with damaged lateral buds. Everyone's major concern was saving most of the crop.

Damage to lateral buds was more severe in the northern area but of greater consequence in the southern area. Protracted rains in summer and fall delayed planting in the southern parishes and many growers were faced with planting large acreages with damaged seed cane. Bud discoloration was used as an index of seed cane quality. Germination tests at the Houma Station showed that freeze discoloration did not mean dead buds. Canes selected for discolored bud tissue resulted in 96% germination in C.P. 52-68 and N.Co. 310 and 56% germination in C.P. 55-30. Although the viability of the buds under ideal conditions was demonstrated, it is questionable that they would survive late planting and a cold, wet winter.

The classic pattern of stalk damage according to location and to varieties was observed, although there were exceptions. Fields of heavy soil, with light stands, in low areas of the northern region were most heavily damaged. Cane in some fields in these areas was frozen to the

ground. Fields of light soil, with heavy stands of tall cane in the southern area showed much less damage. Cane in some fields had damage limited to the terminal bud. Differences in stalk tissue damage were apparent in commercial varieties. N.Co. 310 showed the least amount of tissue damage, followed by C.P. 44-101, C.P. 52-68 and C.P. 55-30. The most severely damaged variety was C.P. 47-193. A wild cane from India, *Saccharum sinense* v. Rakhra showed the most resistance to freeze damage at the Houma Station. Several field grown stalks of this variety had intact terminal and lateral buds, no frozen stalk tissue and from 50 to 80% of the leaf area remaining green.

Studies of the deterioration of cane following light (Coleman, 1952, 1953) and severe freezes (Irvine, 1963, 1966) have been made. The 1966 freeze permitted a study of changes following heavy leaf damage combined with relatively light stalk damage. Because additional, harder freezes failed to complicate the study, we were able to follow these changes for a 92 day period.

Fifteen varieties of plant cane were included in this study. Samples of fifteen stalks were taken from replicated plots at intervals after the freeze. The samples were hand cut, topped at the last hard internode, and milled without burning. Records were kept of stalk weight and crusher juice was analyzed for Brix, sucrose, purity, pH, acidity and gum content.

The results summarized in Table 1 show no significant changes in stalk weight during the 3 month period following the freeze. This is contrary to the opinion of some growers who felt that their cane tended to dry and lose weight as the harvest season progressed.

A statistical analysis of the sucrose date in Table 1 showed that

the decline in crusher juice sucrose during the sampling period was significant at the one percent level of probability. A correlation coefficient of -0.82 was obtained and a regression coefficient showed that sucrose decline 0.014% per day. This rate of decline is less than that reported by Bourne (1935) and the decline was barely evident in the Louisiana mills when the harvest season was completed at the end of December.

Following a freeze, sugar house difficulties are associated with decreases in purity and increases in acidity. Table 1 shows that the reverse occurred after the 1966 freeze. Purity actually increased and acidity decreased. A correlation coefficient of 0.65 for purity increase was significant at the 5% level of probability. A regression coefficient indicated that purity increased 0.027% per day during the sampling period. A correlation coefficient of -0.64 for decrease in acidity was significant at the 5% level of probability. A regression coefficient indicated that acidity decreased 0.0032 ml per day. Decreased acidity is remarkable since even normal, unfrozen cane will gradually increase in acidity (Irvine, 1964).

These changes occurred in cane that was not topped low to improve cane quality, and are a partial explanation of the increased purity experienced by the mills during the harvest season. To grain purity when sucrose decreases, simple sugars must be depleted at a faster rate than sucrose. The gradual depletion of simple sugars, of sucrose and of organic acids that occurred probably reflects the metabolic requirements for respiration, bud germination and suckering during the long sampling period.

The failure of gums to increase can be attributed to the relatively light stalk damage. Frozen stalk tissue in the cane in this test was

limited to the top 1 to 2 internodes and this tissue was removed in the normal topping operation. In badly frozen cane the gum content may be 4 to 6 times the value shown in Table 1.

The data presented in this and in previous studies suggest that the amount of frozen stalk tissue determines, in a large measure, the length of the post freeze harvest. Cane with completely frozen stalks may last from one to two weeks. This study has shown that cane with completely frozen leaves but with little stalk damage may be of acceptable quality 3 months after freezing.

The amount of damage in the experimental plots in this study was not typical of all of the cane in the sugar belt. A considerable amount of cane was badly frozen, and growers had to top low and harvest rapidly to prevent a loss in quality. Officials of the American Sugar Cane League estimated that losses due to the Nov. 3 freeze amounted to twelve million dollars. Losses were held to this level by extreme care in the harvesting operation and by increased mill capacities.

Table 1. Changes in sugarcane quality following freezing at 24°F on Nov. 3, 1966, 15 varieties.1/

Days after freezing	Stalk weight	Crusher juice analysis			
		Sucrose	Purity	Acidity	Gums
	lbs.	%	%	ml 0.1N NaOH/10 ml	mg/10 ml
1	2.43	14.31	83.42	2.10	1.68
7	2.60	13.72	83.48	2.04	2.55
14	2.40	14.26	84.64	2.18	2.15
20	2.41	14.31	85.20	2.03	2.00
28	2.45	13.88	83.90	2.01	1.78
42	2.50	13.13	83.51	2.12	2.40
49	2.51	13.25	84.65	1.97	2.08
61	2.52	13.13	85.29	1.89	2.40
77	2.40	13.55	86.25	1.86	2.27
92					
Significance of change	NS	Sig at 1%	Sig at 5%	Sig at 5%	NS

1/Data obtained from 34 samples for each date with 15 stalks per sample.

LITERATURE CITED

Bourne, B. A. 1935. Effects of freezing temperatures on sugarcane in the Florida Everglades. Fla. Agric. Expt. Sta. Tech. Bul. 278. 12 p.

Coleman, R. E. 1952. Studies on the keeping quality of sugarcane damaged by freezing temperatures during the harvest season 1951-1952. Sugar Bul. 30(22): 342-343.

Coleman, R. E. 1953. Physiology studies conducted at the Houma Station during 1952. Sugar Bul. 31(22): 379-381.

Irvine, J. E. 1963. Effect of severe freezing on quality of mill cane. Sugar Bul. 42(5): 54-58.

Irvine, J. E. 1964. Variations in pre-freeze juice acidity in sugarcane. Sugar Bul. 42(23): 317-320.

Irvine, J. E. 1966. Testing sugarcane varieties for cold tolerance in Louisiana Proc. Internatl. Soc. Sugar Cane Technol. 12th Cong. In press.

Irvine, J. E. and J. J. Friloux. 1965. Juice acidity and gum content as measures of cane deterioration. Sugar y Azucar 60(11): 58-59.

USE OF MULTI-ROW EQUIPMENT

Eugene H. Graugnard
St. James, La.

The use of multi-row equipment offers an opportunity toward better utilization of field labor in sugar cane culture. This is a trend which is evident in all types of row crops brought about by constantly increasing costs.

First, let us look at the developments that have come about over the years, our present position and the future. The following are averages:

Capacity Ac/day	Row multiples	H.P. Tractor	Tractor equipped	Cultivating tools
12	1	25-30	steel wheels	plows disks (wood bearings)
15 25	1 2	30	Rubber tires	metal bearings
20 45	1 early 3 row	50-60	Power steer hydraulic	
60	3	75-90	diesel	sealed, antifriction bearings.
100	3	100 plugs	Electronic assists to operator	

This is the era of the 75 to 90 HP tractors which represents a period of approximately 30 years of development. If the past is an indication of future developments, the last suggestion is in the realm of possibility.

The ways to increase effective working capacity of this equipment is by:

Increased speed - presently near practical maximum

Operator comfort - much improved, more in sight

row lengths w/o turns wide fields	Panelist (Mr. Burleigh)
Combination of operations =	presently in use, increasing with higher HP
<u>use of multi-row equipment</u> -	increasing use

Some of the things that have made the above possible are improved engineering developments in the field of steels, bearings, greases, rubber tires, hydraulics and hydraulic controls, operator comfort and higher HP per pound of engine weight. All of these improvements have been made available to us with a price tag, however it is interesting to note that the dollars per hour of operation do not increase in a straight line relationship to the amount of work performed. The larger size tractors and/or equipment will accomplish more work per dollar than their smaller counterparts.

The following table consists of parts taken from "Preliminary Estimates of Sugar Cane Machinery Costs" By Joe R. Campbell and Donald P. Couvillion at Sugar Cane Short Course - 1967

Diesel tractors - operation costs per hour excluding operator

Small Tractor	Medium Tractor	Large Tractor
$1.664	$2.290	$2.634

The above figures with a life of 10 years and annual use of 7-800 hours

	Double chopper	3 Row cultivator
Dollars per hour -	$0.549	$1.020

with annual use of 300 hours

The above table shows that a tractor capable of three times the work is <u>less than twice</u> the operating Cost of the small tractor.

($1.684 - $2.634). The same comparison can be made for cultivation equipment (chopper $0.549 - 3 Row $1.020). The next area of savings is that 3 row equipment will require approximately one third of the labor per acre as will single row equipment. The third area of savings is that one third the number of row end turns are required by 3 row as compared to single row equipment, with turns accounting to an average of 15% of working time. As an added bonus is reduced soil compaction by tractor tires.

These are some of the uses of multi-row equipment around the cane area. Some of you may know of some in addition to this list.

Barring off and dirting - 3 row
Fertilizing - gas, liquid, solid or combinations - 3 row
Rotary hoe and bar hoeing - 3 row
Row plow - 2 and 3 row
Row marking - 2, 3 and 4 row
Row opening for planting - 3 row
Covering cane - 3 row
Spraying, dusting - 3, 5, 6, 7 row
Subsoiling - 2, 3 row

Disks - 13-15 feet width
Plows - 5, 6 bottoms

To properly use the efficiency offered by multi-row equipment we must take a page from the book of our fellow farmers who grow cotton, corn or beans; whom we envy with their endlessly long straight uniform rows. There is available to these farmers 2, 4, 6, 8 and 12 row equipment. None of these farmers would think of planting with a 2 row planter if he planned to cultivate with a 6 row cultivator. All of the operations are made with the same row multiples of equipment, and is a precise operation. If full advantage is to be taken of the multi-row equipment all operations must be carried out in the same row sets especially starting with row opening for planting and these row sets must have a

set pattern in the field such as starting on the south side progressing to the north.

Lest we be lulled into a sense of false security there are times when we must throw away the book including this paper such as rutted fields and unmanageable heavy soils which yet may require single row equipment (including some profanity) for some operations. In certain soil types it is more practical to make numerous multi-row light operations as opposed to combined operations since sun and air couple with time interval improves workability of these soils.

THE REDUCTION OF FIELD LABOR REQUIREMENTS THROUGH LAND GRADING

C. H. Burleigh
Southdown, Inc.
Houma, La.

The term, "land grading," as used in this discussion, is intended to include the various practices now being employed throughout the Cane Belt to improve surface drainage and to minimize the frequency of quarter drains and field laterals required for adequate drainage. These practices include cut-crowning or turtlebacking, land smoothing, leveling, and precision grading. It is often as difficult to arrive at an accurate "dollars and cents" evaluation of the benefits to be derived from these practices as it is to get the true facts out of Washington these days. None the less, these benefits are real and they do represent dollars and cents of income to us, often much more than we realize. In general, the more complete and precise the job of grading, the greater the potential savings. Let us take a look at the various grading practices and the potential savings to be derived from them.

Precision Land Grading

This is the most precise and complete of the field grading work being undertaken, the most expensive and it produces the largest potential savings. Precision grading is generally practical where there is a natural slope to the land on the order of 2 to 5 inches per 100 feet, and where the soils are mixed to light in texture. We have had little success in trying to grade areas of Sharkey clay, for example. In our Houma Division we believe about half of the 6,000 acres in cultivation are suitable for precision grading. Precision grading requires careful

surveying of the areas to be graded to determine the natural slopes present and to locate the necessary outlet ditches. The field is then staked out in 100-foot squares and a cut-fill plan is prepared which shows the cuts and fills necessary to develop a continuous and even slope along the length of the row and across the lower end of the rows to the outlet ditch. This plan is prepared and calculated to fit the contour of the land and to utilize all natural slopes possible to minimize the amount of soil to be moved. Soil Conservation Service technical help is generally available for planning and checking the work, and most districts provide for some federal cost-sharing. After the planning is complete, construction generally begins with the filling of ditches and major depressions with a motor grader or dozer, followed by cutting and filling the high and low areas with some type of planing or gated scraper and repeated smoothings with a land plane. Finally, a broad, shallow V-drain is cut across the lower end of the field adjacent to the headland, and the field is ready to set up in rows.

Costs will vary considerably with the yardage to be moved and the distances involved. Our direct costs on 400 acres completed to date with our own equipment and labor have averaged about $35.50 per acre. This does not include charges for equipment depreciation and supervision.

Now what do we get for our investment? Our precision grading work has increased the size of field units or cuts from 2 to 3 acres between ditches up to 10 to 30 acres. About 75 per cent of the split ditches and all of the conventional drains have been eliminated. The one V-drain at the lower end of graded fields is easily maintained with a grader blade or motor grader. Wet spots are eliminated and surface

drainage is faster and more uniform. Culverts are eliminated 75 per cent. Headlands are wider and better drained. From 5 to 12 per cent more useable land is made available, and this is usually the best land on the plantation. Seventy-five per cent of the source of Johnson grass reinfestation is removed with the ditches. The larger field units, the elimination of cross drains and wet spots, the elimination of most of the odd rows, the wider headlands, all contribute to a noticeable increase in the speed and efficiency of all mechanical operations; particularly those operations involving multiple-row equipment. Fallow fields can be disced or chiseled and plowed (with 2-way plows), in several directions for more thorough land preparation. Operator fatigue is greatly reduced and equipment maintenance costs are lower. (In our average fields, a one-row tractor chopping 15 acres of land will cross a quarter drain about 450 times in 10 hours of operation. At operating speed, the shock imparted to tractor, tool, and operator is considerable and expensive.) Cane yields are increased from 10 to 20 per cent, depending on the severity of the drainage condition and Johnson grass infestation eliminated. It appears now that most of our precision graded fields will produce profitable third stubble crops where very few profitable third stubble crops have been grown before. The total savings possible will obviously vary with individual conditions. Based on 1965 cost figures, our savings look like this.

1. <u>Reduced ditch and drain maintenance</u> $4.50/ac.

   A 75 per cent reduction in direct labor costs. This does not include the cost of owning, operating and maintaining drain machines.

2. <u>Reduced Johnson grass control costs</u> $1.30/ac.

The elimination of 75 per cent of the ditches produces a corresponding reduction in the source and rate of Johnson grass re-infestation. The cost of all operations designed primarily for weed control are reduced, spraying, cultivating, and fallow plowing, to name a few. I have used 10% of cultivating and chemical weed control costs as a savings figure, although I am sure the savings will be much greater as more of the area is graded and weed pressure is reduced.

3. <u>Improved efficiency of all mechanical operations</u> 2.80/ac.

I have used a figure approximately 10% of the cost of all mechanical operations. I am sure this is conservative and that the savings will be greater as we use more of the larger equipment which becomes practical with larger field units. Multiple-row row plows covering 50 or more acres per day, disc harrows capable of discing 150 acres per day, and other high capacity equipment can be used with efficiency where formerly they would have difficulty in turning in the width of the average cut.

4. <u>Lower equipment maintenance</u> ???

I have no figure, estimated or actual, for this saving although, if you will multiply

the 450 drain crossing jolts by the number of days worked, I am sure you will agree that there will be less maintenance.

5. Increased yields $24.00 to $40.00/ac.

While we have not attempted any accurate and controlled yield tests, our precision graded fields have consistently yielded three to five tons more per acre than comparable adjoining fields with the conventional drainage system. This increase alone would pay for most grading costs in one to three years time.

The total savings in direct labor costs attributable to precision grading looks like $6 to $9 per acre with additional savings in materials and maintenance costs to be added. In addition, we get a yield increase worth $24 to $40 per acre and the probability of an increase in profitable third stubble crops with the attendant reduction in annual planting costs. Obviously, if your field conditions are such that you are growing Johnson grass-free cane in larger and better drained plots than we are at Southdown, you will derive less benefit from precision grading.

Cut Crowning or Turtlebacking

The savings attributed to precision grading will generally apply to a proper job of crowning, although to a lesser degree. We are confining our crowning work to those areas and soils which are not suited to precision grading. These include the very heavy soil types and

those areas where the natural slopes are so small that we would have to move excessive yardages of soil to develop the necessary 2% slope for adequate surface drainage. The typical cut in these areas will be about 100 feet wide between ditches and will have three to five drains in 800 feet of row. If a good job of planing is done after the crowning operation, most of these cuts can be doubled in size, eliminating half the ditches and one-third to half the drains. This has been done at a cost of $15 to $16 per acre using our own dozer and motor grader in combination with the Conservation District equipment.

The savings in field labor requirements obtained from crowning amount to half to two-thirds of that obtained from precision grading, or $3 to $6 per acre. Yield increases have generally been somewhat lower, on the order of one to three tons per acre.

Land Smoothing or Leveling

The term "Land Smoothing" is generally used for the routine planing of fallow fields prior to setting up rows and is designed to fill the minor depressions left by mechanical operations over the three or four year cane cycle. As such, it is essentially a part of the land preparation procedure, and an essential part of crowning and precision grading work, and any savings derived from it have already been covered.

There is a sort of compromise grading operation referred to as land leveling, which is used in certain situations. Fields having a good natural slope where no crops are grown behind or below the field to be leveled are good candidates for this practice. Some of the narrow ridges where only one cut of cane is grown on either side of a central road, or sections which have a permanent cross ditch bordering the lower

side of the field are good examples. Here we want to eliminate ditches and drains but there is no particular advantage to be derived from building a precise slope into the V-drain since any number of outlets can be used without interfering with the plan for fields behind. In these cases we grade the area for a smooth and continuous row fall, cut the V-drain, and place the outlets wherever low spots in the drain may dictate. This can usually be done less expensively than precision grading in two directions and the benefits are about the same.

In conclusion, let me repeat that a complete program for reducing field labor requirements should include land grading as a base to build on. An efficient field layout requires advance planning, technical help, a lot of supervision, and considerable expense, but the benefits derived will outweigh the costs in a remarkably short time. Good weather helps, also. You do not get much grading work done in a season with over 80 inches of rain! Thank you.

ONE WAY TO REDUCE FIELD LABOR REQUIREMENTS FOR LOUISIANA SUGAR CANE BY THE USE OF AIRPLANE APPLICATION OF HERBICIDES DURING THE PERIOD JANUARY THROUGH JULY

D. C. Mattingly, Asst. Field Manager
Dugas & LeBlanc, Ltd.
Paincourtville, La.

With the never ending overall increase in cost and scarcity of labor the sugar cane farmer must try to economize and get the most work done for dollars spent. Farm labor is getting scarce and costly and it looks as if it will become more so in the future. "Farm production expenses are expected to increase again in 1967. U.S.D.A. predicts an increase about half the size of the 1966 bulge" (2). To stay in the business we must try to keep our man hour cost to produce an acre of cane down to a minimum.

There will be less labor and fewer machines involved in the 1967 crop than ever before. It's a universal decision among farmers (1). For the last few years there has been a change in this direction by many farmers. This was shown recently by Glenn R. Timmons in the October 15, 1966 issue of the "Sugar Bulletin" in his article "Tractor Driver Cost Variations" (4). Some farmers have been faster than others in switching to the new advance technology. I believe the farmers will have to switch to multirow equipment, improved field layouts, minimum tillage and air application of chemicals if they are to decrease their labor force and expense.

Air application of herbicide is nothing new in the cane belt. It is becoming more widely used and will become more important. "The pioneer work of air application of herbicides to sugar cane was done at the Louisiana Agricultural Experiment Station under the direction of E. R. Stamper. He stated that the efficiency of airplane over

ground equipment for the application of herbicides, either pre or post emergence is three to one" (3).

I first became interested in aerial application of herbicides in 1961. We had 95 acres of 44-101 1st year stubble that we had cut bad ruts during the 1960 harvesting season and by the time we were able to get it in shape it became badly infested with Johnson grass. We were considering abandoning this cane, but we did not have enough good cane to replace it. I spoke to Mr. Stamper about it and he recommended an aerial application of Dalapon and Silvex on March 29th, with a repeat application 30 days later of Dalapon. This did a superb job on the Johnson grass at a cost of $14.98 per acre and when we harvested this cane it yielded 27 net tons per acre.

Some farmers have the impression that aerial application costs a great deal more than ground equipment. Available figures show that this is not so.

Let's compare the cost of ground equipment versus aerial application.

As you know, the minimum wage for a tractor driver on Louisiana cane farms during the production and cultivation season is $1.10/hr. this year, but is this your total cost per hour? No, it is not, to this you have to add social security, workmen's compensation, health insurance, furnish them a house and gas or a rent allowance. So you have a direct cost of at least 17¢ to add to your $1.10, which will make it $1.27 per hour for each man hour worked.

Now let's consider our actual tractor and spray cost (January to July):

*Depreciation of tractor and spray, repair labor, material and maintenance of tractor and implements	$1,167.40
Fuel and oil (approximately 2 gals. per hour for 90 days @ 9 hours a day)	220.60
	$1,388.00

*810 hours (used)

THIS AMOUNTS TO $1.71 PER HOUR, COST OF TRACTOR

If we would have used a high boy instead of a tractor we would have had to use two, the cost of which would have been: depreciation, maintenance, upkeep, fuel, oil, etc., for a total cost of $2800.00. Spraying 2,754 acres it would cost $1.02 per acre.

COMPARING THREE WAYS OF SPRAYING ON A PER ACRE COST:

Tractor and Spray	High Boy	Aerial Application
$1.27 per acre	$1.16 per acre	$1.00 per acre
Had 1760 acres of cane, but sprayed 2754 acres; some acres sprayed once, others twice or more. It required 92 working days for spraying, 2 men to crew spraying 30 acres* per day. The cost per acre was 76¢ for labor and 51¢ per acre for tractor, for a total of $1.27	80 acres per day, labor cost 14¢ per acre, spray depreciation, etc., cost $1.02 per acre, for a total of $1.16 per acre	

The above figures show the actual aerial spraying is cheaper. The only difference is that the airplane usually uses 10% more chemicals because of the ditch banks and headlands.

It is hard to compare weed control practices from one plantation to the next. Varying conditions dictate different practices. So for this reason it is very difficult to compare actual cost from one plantation to

*Figures based on actual cost of average cost of 33 tractors belonging to DUGAS & LEBLANC, LTD.

*Actual man hours it would take to duplicate the amount of spraying in 1966.

*If a more concentrated mixture was used we could easily have sprayed more than 30 acres and reduced our labor cost.

the next. Following is a table which shows actual comparative cost of chemical and application to control weeds and grass with ground and aerial application on three (3) plantations from 1000 to 2500 acres. But we should keep in mind each had a little different situation.

Plantation "B" applied some chemical in the fall on 190 acres of plant cane and this cost is not shown here because this study is from January through July. Plantation "C" had a problem with some plant cane and had to add an additional application to control Johnson Grass rhizomes.

One of the main reasons for the difference in practices on Plantation "B" is because of the corn history of the plantation and the Johnson grass problem. Plantation "B" has been under a rigid weed control program for a few years and it is improving rapidly. The plans for 1967 will be comparable with 1966 with the exception of the plant cane which will be all handled by air.

According to our scientists, aerial application can be used under most circumstances, but if you have a heavy infestation of Johnson grass it is advisable to use a ground spray where you can concentrate your chemical on the top of the row where it is most needed. Some farmers might find it advisable to use a combination of aerial and ground program. Where you have a heavy infestation of Johnson grass and areas which are hard to get to with a plane use a ground spray. Other areas I believe it pays to use an airplane.

Weed control is one of your most expensive and intricate parts of all your field operations and we believe that timing of your application is the most important part of your weed control. This is where the airplane normally has an advantage. The airplanes can usually put the chemicals down at the best time. With ground equipment you sometimes

Comparative Cost of Chemical and Application to Control Weeds and Grass Applied with Ground and Aerial Application on Three Plantations from 1000 to 2500 Acres.

	Plantation "A" - 1040 acres	Plantation "B" - 1760 acres		Plantation "C" - 2564 acres
AIRPLANE APPLICATION	Plant Cane-280 acres-$12.20/acre Stubble Cane-760 acres-$6.12/acre	Plant Cane-477.8 acres-$2.96/acre Stubble Cane-253.5 acres-$4.01/acre		Plant Cane-1012 acres-$16.02/acre Stubble Cane-1522 acres-$4.75/acre
GROUND EQUIPMENT	Plant Cane - None Stubble Cane - None	Plant Cane-667 A. $8.04 -chemicals 1.27 -application $9.31 -Total cost	Stubble Cane 1st appl.-1094 A. $5.07 -chemicals 1.27 -application 2nd appl.- 261 A. $ .30 -application $6.64 -Total cost	Plant Cane - None Stubble Cane - None
GROUND PLUS AIR	Plant Cane - None Stubble Cane - None	Plant Cane-477.8 A. $2.96 -air appl. 9.31 -ground appl. $12.27 -Total cost	Stubble Cane-253.5 A. $4.01 - air appl. 6.64 -ground appl. $10.65 -Total cost	Plant Cane - None Stubble Cane - None
	Yield - 1966 - 23.8 Std. tons/acre	Yield - 1966 - 23.8 Std. tons/acre		Yield -1966 -24.6 Std. tons/acre

Flying based on $1.00/acre

Flag man cost not considered in aerial application.

have to start a little sooner than you want, and occasionally still get behind.

In summary, these figures have shown very little differential in cost between ground and air application spraying and total weed control practices. The major "pay off" features of air application are that timing is usually better, and I believe grass and weeds are controlled better. By using air you can usually eliminate a few year round employees. Conditions vary from one plantation to the next and no one thing can be recommended for all, but with every employee you eliminate by using air application of herbicide you save quite a few dollars. From January to July 31, an employee normally works 122 days @ $1.27 an hour or earns approximately $1400.00. So for every employee you eliminate you save quite a few dollars.

LITERATURE CITED

1. Barnes, Harris H., Jr. "The New Crop Year," The Progressive Farmer, January, 1967.

2. Farm Costs Soared in 1966 and Will Rise again in 1967: The American Farm Bureau Federation's Official Letter, XLVI(2): 5. January 2, 1967.

3. Mullison, W. R. 1966 Changing Trends in Herbicides. A Chemical Industry Viewpoint Proceeding Southern Weed Conference 19: 20.

4. Timmons, Glenn R. "Tractor Driver Cost Variations," The Sugar Bulletin 45(2): 23. October 15, 1966.

MECHANIZED FEED TABLE

John Copes, W. R. Hester,
Camp Matens & S. F. Little
The Thomson Machinery Co., Inc.
Thibodaux, Louisiana

Introduction

What's $100,000 to you?

Its dumping 133 one-hundred-pound bags of sugar in the Bayou. Would you think of doing that? No, you surely wouldn't, and it won't be long until <u>you wouldn't think of letting sugar cane ever touch the ground</u> in the State of Louisiana. For as we are all aware, every time a load of cane hits the ground, a certain loss of juice and sucrose occurs, and a certain amount of trash is picked up.

Louisiana, Puerto Rico and Australia are the only areas of cane production in the world where harvesting has been fully and completely mechanized. Within a decade after the end of World War II, nearly all of Louisiana cane fields were cut with a mechanical harvester. Labor became increasingly scarce during these years, and the labor shortage problem is becoming even more serious, requiring a really hard look at the mill yard handling equipment, as well as harvesting equipment.

Recent engineering developments at Thomson Machinery Company have resulted in a successful cut-load harvester now being tested in Florida where the cane is harvested and cut into 18" to 24" lengths and loaded on the wagon in a one-man operation. Looking at Louisiana and higher tonnage canes, in the future this type field operation will be required, eliminating the cane ever touching the ground. This machine is now being successfully tested at U. S. Sugar Corporation, Clewiston, Florida, cutting and loading up to one ton per minute.

Our experience at Valentine Sugars in elimination of additional hand labor in the cane yard is our subject today, and I would like, at this time, to acknowledge thanks to Messrs. T. M. and Frank Barker, and other members of the Board at Valentine for their excellent cooperation and assistance in testing and working of this table.

The change to bulk handling of wagons and trailers is a reality that will decrease, by a substantial percentage, the number of wagons, trailers, tractors and trucks needed to maintain an ample supply of cane at the mill during grinding season, even under increased mill rates. The fact that this system replaces labor that in many instances is no longer available, is as important a factor, as the money saved in these units and their maintenance and operation.

Let's face it -- the days of stoop labor at any price are limited. And with the replacement of labor and elimination of the necessity of hiring additional labor, a natural consequence is the resultant savings of end capital output.

In the mill of Valentine Sugars, the mechanized feed table they installed this past grinding season eliminated six men in their cane handling yard and a total of 16 men in the over-all handling operation, which, calculated on a 70 day grinding season such as Louisiana has, resulted in an actual cash labor operational savings of approximately $20,160. To summarize:

Reduction of 6 men in the cane yard,

Reduction of 8 trucks and trailers, with drivers,

Elimination of 2 field derricks with operators,

Or, 16 men working 12 hours per day x $1.50 minimum per

hour computed over a 70-day period equals $20,160. in savings in labor.

But more important, it replaced these men, who were not available. If this system is carried further back into the field operation, this figure could conceivably be doubled, resulting in a rapid pay off on their table installation.

Technical Aspects

What are some of the technical aspects that had to be considered in making this table operate with absolutely no down time and to the Barkers' complete satisfaction?

A number of factors must be kept in mind when designing a table and washing facility that will be ample to maintain the desired rate of grinding. Some of these are outlined as follows:

1. Thickness of the cane mat
2. Table width and required speed of feed chains
3. Gallons per minute water requirements
4. Length of table
5. Table inclination
6. Height of table walls
7. Power requirements.

Experience tells us that in order to insure that good washing and dirt removal take place, the thickness of the cane mat should not be more than 12" to 18" thick. This dimension is measured from the working surface of the washing table to the tip of the arms of the leveler. If the thickness of the cane mat is greater, no matter how much water used or at what pressure applied, the top dirt simply will accumulate

in the bottom layer of the mat, resulting in dirt being sent into the mill, as the dirt adheres to the cane and does not wash away.

Therefore, to insure the proper thickness of cane mat, the curved arms of the cane leveler, moving at a continuous pre-determined speed revolve, leveling the cane into the required thickness for the mill carrier and resulting in a cleaner wash of the cane.

Since the thickness of the cane mat is such an important factor and cannot be changed, there remain two other factors to insure that the right amount of properly washed cane is discharged on the mill carrier to insure the desired mill feed rate. These are the width of the table and the required speed of the feed chains to give an effective density of cane after passing under the leveler. Example, cubic feet of cane (area X speed) at a predetermined density, translated into tons of cane per hour ground.

The next item to be kept in mind is the water requirements in gallons per minute (GPM) at the correct nozzle pressure, properly distributed across the feed table for washing the cane. A rule of thumb is 1 gallon per minute per ton of cane ground per day. This amount can be modified according to water supply, but it is not recommended that anything below 3/4 GPM per ton of cane ground per day should be used. The table at Valentine handles 3000 to 4000 tons of cane per day, pumping 3000 to 4000 gallons of water per minute during the wash process. The table is also equipped with a trash drag that either removes the trash onto a waiting dump truck for removal from the cane yard, or onto the carrier for mill disposal as bagasse.

The next factor to consider is the length of the table. The ability to continue use of present derricks for night time feeding,

as well as the nature and size of bundles, wagons, and trailers that would be dumped on the table were considered in determining the length and width of the efficient table.

Providing there are no limitations of available room, the length should be a multiple of the greatest number possible of the various sizes of cane loads the table will receive. Due to the variety of bundles, from derrick grab to truck trailer compartment, the length in most cases, will be a compromise, but generally between 30 and 45 feet. There must be enough room between the leveler and the feed end of the table to accommodate the largest load anticipated it will receive.

The other dimension necessary is the height of the table walls. They must surely be high enough to receive the largest dump expected, and to prevent the leveler from kicking any cane over the walls, yet low enough for effective operator vision and maintenance.

To this point, our discussion has been primarily on table dimension. Another important factor is the inclination of the table. The inclination is determined by the carrying ability of the feed chains and the need for the water and trash to effectively fall into the trash drag. If the inclination is at too great an angle, there would be a tendency for the cane not to be conveyed and leveled properly and the rolling action of cane moved by the leveler would be lost. If the inclination is not great enough, additional horsepower would be required on the leveler to prevent its choking up and breaking the cane as well as not providing the proper washing and trash handling, resulting in more trash being carried into the mill.

An important design feature is the headshaft, whose design and diameter determination is based on the power and torque requirements.

This is a one-piece shaft that goes all the way across the table and must be keyed properly to take the drive sprockets of the feed chains which are cast steel for strength, and split for easy removal without removal of the shaft. These conveyor chains (size C111), at predetermined spacings, move the cane into the mill at variable speeds required by a given mill rate, furnishing an even mill feed. The C111 chain is of adequate strength to move the greatest anticipated loads without fear of breakage, and resultant down time.

The number and type of bearings to be used on these was determined to be one bearing every two chain sprockets and since the RPM is low, common, ordinary babbitted, split pillow-block bearings were used, with a simple means of central lubrication installed. The tail shaft is of a special patented design, employing individual bearing supports and each chain sprocket employing the use of a dead shaft and "gatke bushed" sprockets.

It is desirable that a minimum amount of trash and small pieces of cane be carried by the table feed chains as they go around the headshaft, discharging onto the mill carrier. This is accomplished by a system of cylindrical sections and vertical wedge shaped plates into which the feed chains seem to disappear as the cane is deposited on the mill carrier.

Feed chain guides with replaceable wear plates assures long life of the table floor as well as reducing wear on chains.

The number and distance between feed chains is of great importance in that too few chains will result in a tendency for the leveler to windrow the cane instead of doing an effective job of rolling it back and leveling it out.

In designing the leveler, a heavy duty pipe was chosen of great enough strength to withstand the strain of the kicker action and small enough to not affect the desired length of the kickers.

The especially designed kickers are welded on the pipe shaft, starting as close to the table walls as practical, and so arranged as to give proper balance to the shaft as well as effectively leveling out the cane with no piling or windrowing effects.

The leveler, for best results, must run at a constant speed, fast enough to level the largest loads on the table, yet slow enough to avoid any throwing of the cane over the sides or back of the table.

The entire table and related components are constructed of Beam and Channel steel with press break side and stringers for strength. Ample power is supplied to the table by a 30HP electric motor coupled to an Eddy current variable speed coupling and suitable speed reduction to turn the headshaft at the variable required RPMs to insure an even supply of cane to the mill carrier.

The Eddy current coupling is adaptable to remote control, either manual or automatic.

Conclusion

In conclusion, gentlemen, we would like to show a move of the table in operation at Valentine and leave you with these thoughts:

that due to the increased minimum wage law,

the problem of getting labor, and

the advent of new type harvesting equipment being tested,

plus the Viet Nam conflict causing material shortages

and long lead times,

we urge you to seriously consider immediately your plans for installation of this type handling equipment at an early date for installation before the 1967 grinding season.

Thomson Machinery Company has obtained the services of Mr. John Copes, well known to all of you in the mill business, to serve as Director of their mechanized cane handling systems installation studies, and Mr. Copes and Thomson Machinery are always at your service for consultation.

MECHANICAL SEALS FOR SUGAR MILL SERVICE

John C. Copes
Mechanical Engineer
Baton Rouge, La.

Sugar houses are now realizing the definite need for reducing cost in mill operations. One means of achieving cost reductions is by improving centrifugal pump performance. This is accomplished by the use of mechanical seals which when chosen carefully and applied correctly, can contribute substantially in reducing maintenance as well as operating costs.

Mechanical seals have many advantages over packings. They reduce maintenance, eliminate shaft wear, stop leakage, reduce the danger of contamination, and reduce friction. They help improve general housekeeping and improve the overall appearance and safety in a mill. But mechanical seals can be more trouble than they are worth if they are misapplied or not installed and maintained properly.

The proper selection of a mechanical seal can be made only if the full operating conditions are known. These conditions are as follows:

1. Liquid
2. Pressure
3. Temperature
4. Characteristics of liquid
5. Type of pump

A flow of from 40 to 60 drops per minute out of a normal packed type stuffing box is required to provide lubrication and to dissipate generated heat. If the pumped liquid contains solids in suspension, leakage out of the stuffing box must be minimized. The solids will impinge on the packing and score the shaft sleeve. By far, one of the major difficulties with mechanical seals causing excessive wear is

solids - dirt or grit in the liquid being pumped. For example, faces on mechanical seals have operated in excess of 35,000 hours at pressures ranging from 100 to 500 pounds per square inch at the seal face, and rubbing speed of 3000 feet per minute, with practically no perceptible wear in the seal faces, primarily because the liquid handled was clean. In another case, a set of seal faces lasted for 2 to 3 months in low-pressure applications with abrasive liquids.

Here again, a seal can be likened to a bearing which has a fine lubricating film between the stationary and rotating parts. If particles of abrasive solids are introduced between the two faces, the wear is rapid; therefore, we use all sorts of devices to keep solids away from the seal faces. However, these devices can be costly and complicated; therefore, a new design for mechanical seals has been introduced to the market and is referred to as a <u>split seal.</u>

<u>Split mechanical seals are a compliment to the mechanical seal art and compensate for the disadvantages of conventional seals in that dismantling of the pump to change seal face parts is not necessary</u>. Split mechanical seals are recommended for those hard to seal slurries where because of the product handled a conventional seal will not do the job. Hard facing of the split inserts is recommended in order to extend the life of the wear parts and materials used are tungsten carbide, carboloy, stellite, ceramic, etc. The application and use of split seals are similar in every respect to conventional seals and are in effect identical replacements. We can summarize as follows:

<u>Packed pumps versus Mechanical Seals</u>

<u>Advantages Packing</u>	<u>Advantages Seals</u>
1. Ease of installation	1. No leakage
2. Cheaper initial cost	2. No shaft wear

Disadvantages Packing	Disadvantages Seals
1. Require leakage for lubrication	1. Higher initial cost
2. Shaft sleeve wear	2. *Dismantle pump for change (water or other means of lubrication required if product pumped is not satisfactory)
3. Loss of product	

*This disadvantage does not exist when split seals are used.

Conventional Seals versus Split Seals

1. Use conventional seals for relatively clean lubricating type fluids.

2. Use split seals for abrasive service.

Typical Applications in the Sugar Industry for Mechanical Seals

Conventional Seals	Split Seals
Boiler Feed Water	Raw Juice
Clean Water	Limed Juice
Clear Juice	Filter Mud
Chemicals	Filtrate
	Cane Wash Water

What does all this mean in dollars and cents to sugar mills? We will take a look at a typical example. These cost figures are based on a split seal installation at the St. James Sugar Cooperative during the 1966 grinding season in which the particular pump referred to pumped limed juice for a total of 265,000 tons of cane ground. The pump is an Allis-Chalmers, size 8 x 6 x 17 CW with a 3-1/4" shaft size and is driven by a steam turbine.

Assuming that for a grinding rate of 4,000 TCD, 570 GPM of juice is pumped and the juice has a dollar value of $5.28 per 100 gallons. We observed a stuffing box leakage, with the pump packed, of one gallon every 10 minutes.

Assumptions

1. One gallon of juice leakage every 10 minutes or 144 gallons per day.
2. $5.28 per 100 gallons of juice.
3. Seventy-two days of grinding.
   24 hrs x 6 gal/hr x 72 days x 5.28 = $547.43

Dollar value of lost juice for season = $547.43

Comparison of Overall Costs

	Packed Pump	Split Mechanical Seal
Juice lost	$ 547	$ 55
Packing cost (14 x $10) =	140	
Seal Cost		156
One set of split seal inserts		38
Two shaft sleeves 138.-x2	276	
Labor for Packing Pump 14 times x $5.00	70	
Labor for changing sleeves 2 times x 4 hrs x 2 men x $3	48	
Labor for changing seal inserts 1 time x 1 hr x 2 men x $3		6
Total	$1,081	$255

Savings $826.-

The above reflects a substantial savings and refers to only one pump. What would the savings be for other similar raw juice and filtrate pumps?

Mechanical seals are presently used in the following sugar houses:

St. James Sugar Cooperative
Breaux Bridge Sugar Cooperative
Enterprise Factory
Cajun Sugar Cooperative

Where can mechanical seals be purchased?

Split Mechanical Seals:

C. S. Seal Company
Post Office Box 2163
Baton Rouge, Louisiana
Attention: John C. Copes

Conventional Mechanical Seals:

Durametallic Corporation
3020 Scenic Highway
Baton Rouge, Louisiana
Attention: Dale Fontaine

In conclusion I thank you for giving me the opportunity to speak to you. We have several slides we would like to show you at this time regarding mechanical seals and their installation. After the slides, we will discuss any questions you may have.

ACKNOWLEDGMENTS

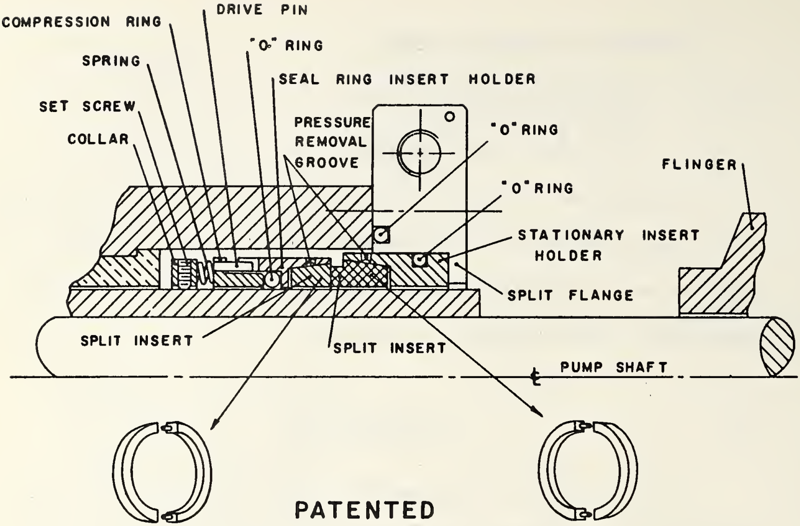
The author wishes to express his appreciation to the following Associates who contributed substantially to test data and material for the preparation of this paper:

St. James Sugar Cooperative
F. A. Graugnard
C. N. Pressburg
Max Rodrigue
Nelson Schexnayder
Philip Giovingo

Breaux Bridge Sugar Cooperative
Octave Gutekunst
Camile Blanchard

Durametallic Corporation
Dale Fontaine

Machinist
Shelby Hanea
Aubrey Allen



Method of Removal and Installation

Split mechanical seals are installed in a conventional manner and removal is accomplished as follows:

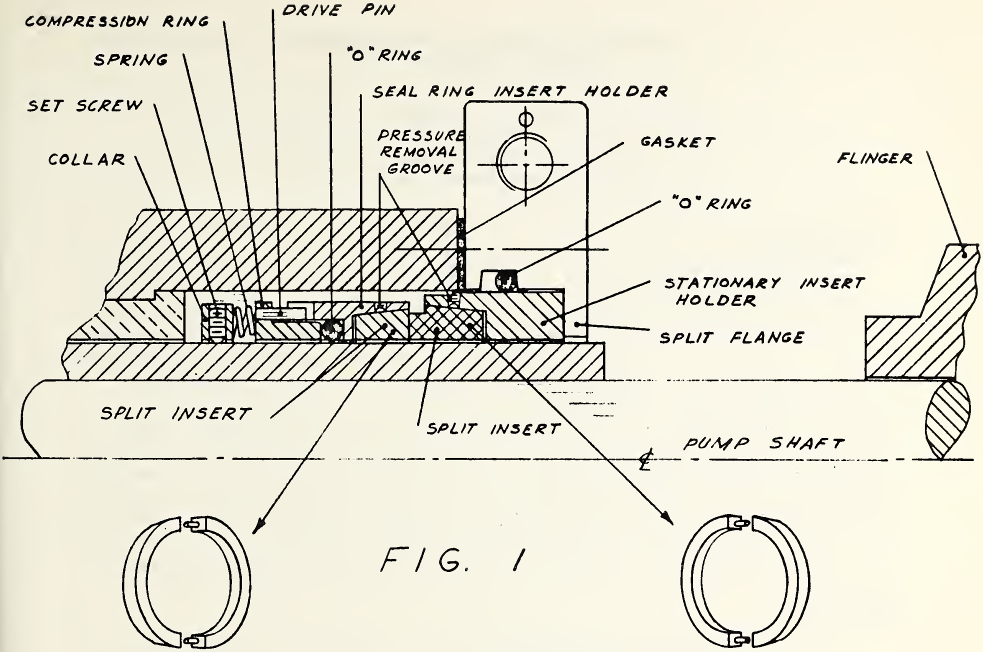
1. Slide back or remove the split housing flange, this will expose the stationary seal part.
2. Remove the split tapered inserts in the stationary part by applying hydraulic pressure in the annular groove under the tapered face. This is accomplished by inserting a grease fitting in the tapped hole.
3. Slide the rotary seal part into removal position and apply hydraulic pressure to remove the split rotary inserts.

New inserts are placed around the shaft and secured into the holder pieces and the faces are brought together to insure correct fitting within their respective holders. Precautions of cleanliness and seal assembly procedures are followed to insure that the parts are correctly assembled.

Before starting operation of a mechanical seal, be sure pump is full of liquid as the seal should never be allowed to run dry at any time.

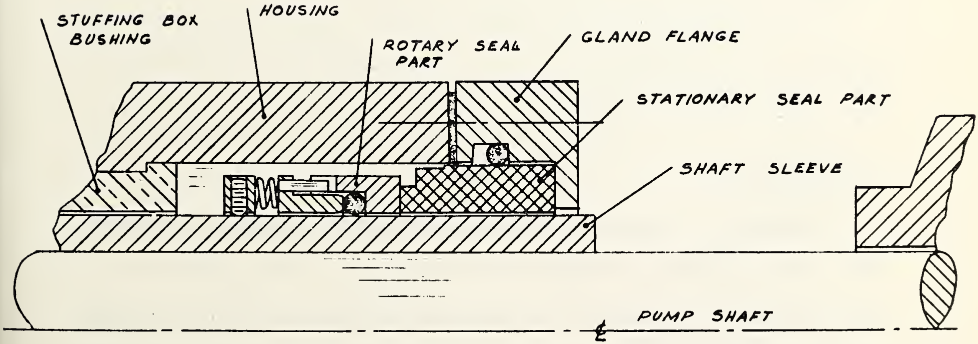
Occasionally mechanical seals have a slight leakage when first started. This indicates that the faces have not quite seated. After a short time leakage usually clears up. However, after allowing a reasonable amount of time and mechanical seal still leaks in excess, then pump should be stopped and seal checked for alignment, positioning and seal faces checked for scoring and wear.

Mechanical seals should not run hot and if such a condition does exist at start, check piping for correct connection, dirt in line, flow of liquid and positioning of seal.



COMPRESSION RING
DRIVE PIN
SPRING
"O" RING
SEAL RING INSERT HOLDER
SET SCREW
PRESSURE REMOVAL GROOVE
GASKET
COLLAR
FLINGER
"O" RING
STATIONARY INSERT HOLDER
SPLIT FLANGE
SPLIT INSERT
SPLIT INSERT
PUMP SHAFT

FIG. 1



STUFFING BOX BUSHING
HOUSING
ROTARY SEAL PART
GLAND FLANGE
STATIONARY SEAL PART
SHAFT SLEEVE
PUMP SHAFT

FIG. 2

OPERATION OF EDWARDS AUTOCANE SYSTEM
VALENTINE FACTORY, 1966

F. L. Barker, Jr., Valentine Sugars,
Lockport, La.
H. P. Dorman, Edwards Engineering Co.,
New Orleans, La.

A. Background

An AUTOCANE System of latest Mark III design was installed at the Valentine Sugar Factory at Lockport, Louisiana, and operated for the 1966 grinding season. The AUTOCANE unit of Valentine was made by Edwards Engineering Corporation of New Orleans and was the fifty-second in the industry and the third in Louisiana. To date there are single and multi-carrier AUTOCANE installations in Florida, South America, Central America, Puerto Rico, British West Indies, French West Indies, Mexico and the Philippines.

The first Louisiana installation was at Glenwood in 1963 and the second at Evan Hall in 1964. Both AUTOCANE installations have operated for each grinding season since original installation.

It is the purpose of this paper to give a brief description of the AUTOCANE, its installation at Valentine, the benefits that were anticipated and the actual operational results.

B. Description

Operation of the AUTOCANE System is based on the average level of cane on the carrier as it passes the control point. The carrier is always driven at a speed which is inversely proportional to this average cane level. Thus, cane delivery is constant for a given tonnage setting.

The AUTOCANE carrier drive utilizes a master speed control panel

which permits adjustments to the cane tonnage from any convenient location at the mill floor.

The Sensing Device (see Figure #1) consists of four swing bars, mounted above the carrier near the point of discharge. These bars oscillate freely as the cane passes under them. Variations in the cane height across the 7-foot width of the carrier at Valentine are thus detected and integrated mechanically to produce a signal corresponding to the average height of cane in the carrier.

This signal is transmitted to the Power Unit, which consists of a 30 HP motor, hydraulic transmission, 25.4:1 gear reducer and oil reservoir with all necessary accessories including filters, cooler and oil gauge. All elements of the Power Unit are interconnected and mounted on a single base frame.

It is the main objective of AUTOCANE Power Unit to produce a controlled, variable output speed from the constant input speed of the electric motor. A fixed displacement hydraulic vane-type pump and motor was chosen due to their inherent high reliability, ease of maintenance, long life, automatic compensation for vane wear, and moderately high tolerance for contamination in the hydraulic fluid. All internal rotating parts of the pump and motor are assembled in a cartridge kit which is easily replaced without disturbing the pump or motor mounting, shaft and connections. Since none of the wearing parts contact the housing, changing cartridge kits makes the performance of the unit identical to that of a new unit. Replacing a cartridge necessitates the removal of four housing bolts and exchanging the cartridge kits and does not, therefore, require highly skilled personnel.

It should be noted that the output speed of the Power Unit is controlled by means of a Bypass Valve in the hydraulic line between the hydraulic pump and motor. Opening or closing this valve, by manual or automatic means, will increase or decrease the carrier speed, thus avoiding the start-stop operation that can be so detrimental to the electrical motor.

The Cane Knives were provided with centrifugal overload sensors, wired in series, to detect incipient overload at the knives and to transmit this signal to the AUTOCANE Power Unit thereby stopping the carrier. Thus the knives clear themselves automatically. After clearance at the knives, the carrier will automatically resume its preselected delivery. This circuit is provided with a manual override to allow operation of the carrier for maintenance without the necessity of operating the knife turbines. Also connected in series with the overload sensors were two remote ON-OFF switches, one located on each side of the auxiliary carrier, and an electrical interlock between the main and auxiliary carrier. The interlock originally installed at Valentine was a pressure switch connected to the inlet steam line on the steam engine driving the main carrier and was used to stop the auxiliary carrier automatically when the main carrier stopped. This pressure switch did not work completely satisfactorily and will be replaced for the 1967 season by a centrifugal speed sensor similar to the units used on the cane knives.

C. Installation

Although it is more usual for a single carrier AUTOCANE System to be installed on the main cane carrier, since the main carrier at Valentine is a simple, carrier-elevator with no knives or other accessories, it was

decided to install this AUTOCANE unit on the auxiliary carrier and to run the main carrier at a constant speed which would be slightly faster than the fastest speed anticipated on the auxiliary carrier.

Figure No. 2 shows the cane delivery system at Valentine, including the four feed tables delivering cane to the auxiliary carrier, which, in turn, feeds a shredder discharging into the main carrier. The auxiliary carrier is equipped with two sets of turbine-driven cane knives and a turbine leveler at the end of the carrier.

The AUTOCANE Sensing Device was installed on the existing carrier sideplates between the second set of knives and the end of the carrier.

The AUTOCANE Power Unit was installed on a small platform constructed directly over the existing carrier steam drive so that the chain from the reduction gearing could be hooked up interchangeably to the existing drive or to the new AUTOCANE drive. Thus, the existing drive could be used as a standby and brought into action with practically no delay, if required.

The auxiliary carrier ON-OFF switches were located on each side of the carrier at point "C" near the cane knives. The master speed control panel was located at point "A" looking down into the shredder but will be relocated to a central location on the mill floor for the 1967 season.

The centrifugal overload sensors were connected to the drive for each knife set at points "S" on the turbine reducer drive shaft and wired electrically to the Power Unit.

The installation was completed just prior to the start of grinding, and took less than 60 man hours, including the electrical wiring and erection of the platform for the Power Unit. No difficulties were

encountered in the erection, nor in the connection of the various AUTOCANE elements and controls.

D. <u>Benefits</u>

Following is a summary of the benefits anticipated from the addition of the AUTOCANE System and the actual results.

1. <u>Personnel</u>:

In past seasons one operator was stationed at point "B" overlooking the auxiliary carrier to control the operations of both the auxiliary carrier and feeder tables. Due to the installation of two new feeder tables for the 1966 season, an additional operator was stationed at point "D" to control the operation of the four feeder tables. Another operator was stationed at point "E", adjacent to the crusher mill to operate the main carrier. The AUTOCANE has eliminated the necessity of an operator at point "A" and point "B" leaving only an oiler for general maintenance. The master speed control panel will be removed from point "A" and centrally located on the mill floor. The mill operation will determine the AUTOCANE tonnage setting as well as general mill surveillance.

Very shortly after the start of grinding, it became apparent that the operator at the end of the main carrier (Point "E") was doing more harm than good by speeding up or slowing down the main carrier. As soon as the main carrier was set at a constant speed (approximately 20 FPM), the two-carrier delivery system came into balance with the Sensing Device on the auxiliary carrier detecting and compensating for immediate variations in cane height. Delivering a constant tonnage of cane to the main carrier running at constant speed will insure a uniform

level of cane in the main carrier. Removing the existing steam engine and replacing it with a constant speed electric motor is anticipated for the 1967 season.

It is also planned to add a limit switch to automatically stop the main and auxiliary carriers when the top crusher roll rises more than 3/8", and to start again when the top crusher roll drops to a normal operating position.

Thus, the AUTOCANE will have replaced two operators per shift, leaving manpower required for the two carriers at an oiler and feed table operator.

2. Extraction

There is no question that the continuous delivery of a constant volume of cane afforded by the AUTOCANE control was superior to manually controlled cane delivery. From the figures in Figure No. 3, it can be seen that the extraction during the 1966 season was not only superior to the hurricane years of 1965 and 1964 as might have been expected, but also better than the extraction in 1963, which was considered a good year.

	1963	1964	1965	1966
TCH	146.50	141.00	112.80	130.00
Sucrose	90.54	89.59	89.58	91.60
Maceration	29.10	28.23	28.39	25.68
Fiber	14.64	14.5	15.40	14.43

FIGURE #3

Actually sucrose extraction in 1966 was the best at Valentine in over 15 years.

It is difficult to say, because of the many and various factors involved, just how much of the increase in extraction (1963 versus 1966) was due to the regularity of cane feed, but a fair estimate would be 50%. However, even a half-point pickup in extraction presents a very excellent reason for automatic control of cane feed.

3. Tonnage

Although a comparison of yearly tonnage figures does not indicate an increase in 1966 over 1963, it is extremely probable that this was due to a shortage of cane delivery and two periods of wet weather during the 1966 season. During the last few weeks of the crop, when much of the cane delivery was taken out of manual control and placed on automatic, cane tonnages averaged close to 145 TCH for long periods, with peak tonnages as high as 157 TCH.

Operations at Valentine would tend to confirm the claim that the AUTOCANE, with automatic cane delivery control, can increase normal mill grinding capacity 10% or more over manually controlled delivery.

E. Miscellaneous Operating Data

1. AUTOCANE Stoppages

During the 1966 grinding season, the AUTOCANE failed to function three times, and was displaced for short operating periods by swinging the chain drive over quickly to the existing steam drive.

The first shutdown during the first week of grinding was apparently due to the relief valve being set too low, causing the AUTOCANE drive to stop when a particularly heavy cane load was put in the auxiliary carrier. As soon as the relief valve was properly set the AUTOCANE drive resumed and no further trouble was encountered from this source for the rest of the season. The AUTOCANE relief valve setting is

related to the horsepower rating of the electric motor.

During the third week of grinding the AUTOCANE drive shut down due to the hydraulic fluid overheating. Upon the second occurrence of overheating an investigation disclosed that foreign material in the cooling water had plugged the heat exchanger. This was corrected and resulted in no further overheating.

The last downtime for the AUTOCANE was about midcrop and was due to the carelessness of a maintenance man who, in order to grease the chains, ran the carrier by jamming the manual override on the cane knives. After completing the grease job, he did not remove the jamming device from the override which, after about an hour's operation, resulted in a choke at the cane knives. This was the only knife choke experienced with the AUTOCANE during the entire season.

The total downtime of the AUTOCANE for the season was approximately four hours. This does not include the time loss due to the carelessness of the maintenance man as this was not a fault of the AUTOCANE.

2. Controls

The reaction of the AUTOCANE to the Sensing Device signal, to Manual Controls and to Automatic Override Controls was instantaneous. Carrier stopped immediately on signal with no coast.

As a result of this characteristic and the override controls (centrifugal switches) on the turbine driven knives, there were no knife chokes during the crop, except when the knife sensor was jammed in the manual override position.

Several chokes at the shredder were recorded during the crop which resulted from a manual slowing down of the main carrier without

stopping or slowing down the auxiliary carrier. This allowed the cane to back up through the shredder hammer and bridge across the shredder feed hopper.

This type of choke was eliminated in two ways -- first, by eliminating manual control of the main carrier and setting it to run at a higher constant speed, and second, by improving the interlock (centrifugal switch) between carriers which would automatically shut down the auxiliary carrier when main carrier stopped for any reason.

3. <u>Variations in Cane Delivery</u>

No appreciable difference in the operation of the AUTOCANE, tonnage ground or extraction was observed between day and night operation, even though generally the day cane presented a little more regular mat than the night cane, which was mostly grab loaded.

Under automatic control of the auxiliary carrier, resulting in more constant cane delivery, there was not only an improvement in the preparation of the cane by the shredder, but also there was a very definite smoothing out of the shredder operation due to the more regular cane feed. This is expected to result in lower shredder maintenance and considerably less strain on the turbine drive.

4. <u>Feed Tables</u>

Although some consideration was given to automatically coordinating the feed of cane from the tables to the automatically controlled auxiliary carrier, nothing specific was done in 1966. It is hoped that action in this direction can be taken in 1967.

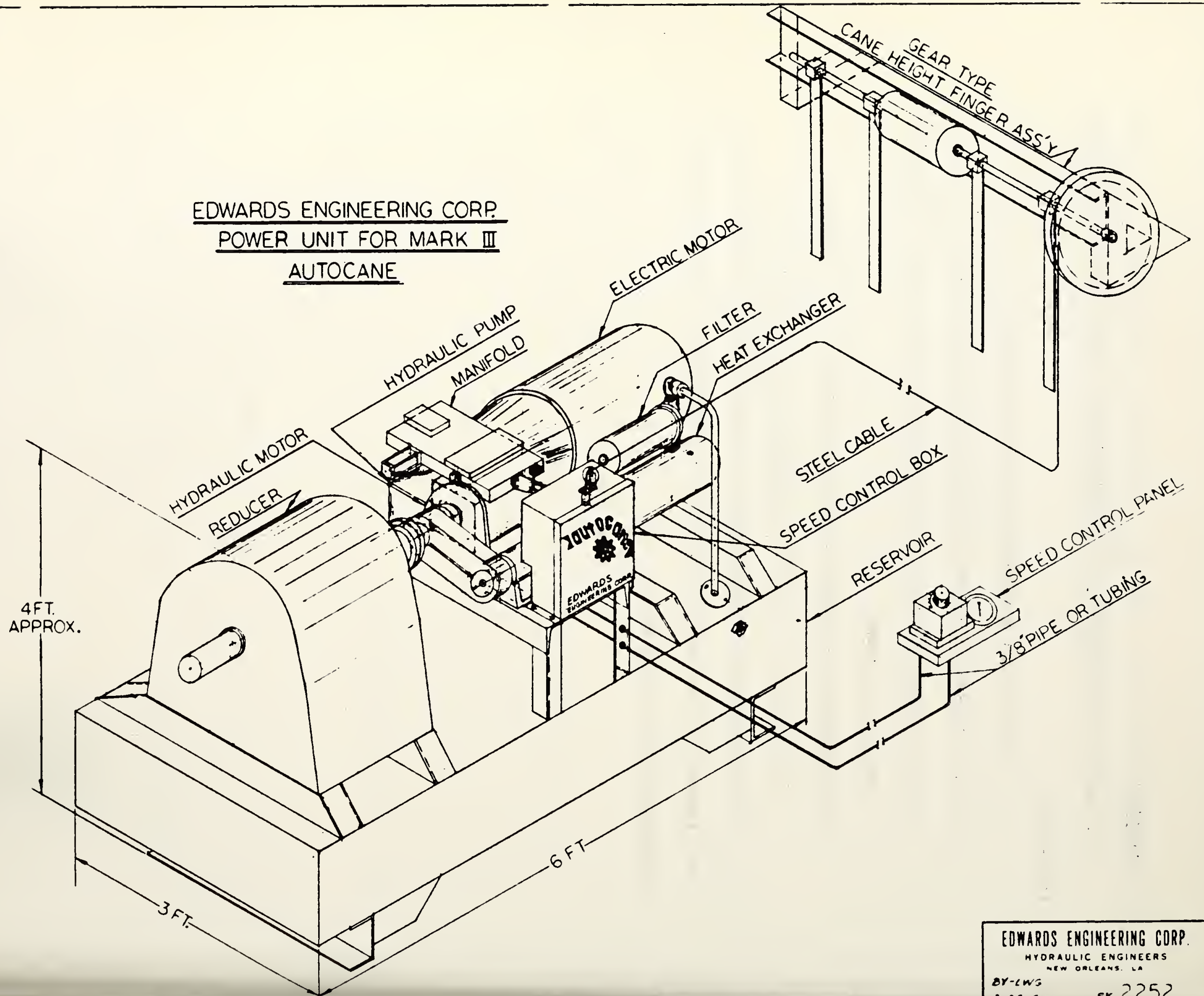
F. Summary

In brief, the addition of the AUTOCANE at Valentine is expected to result in:

1. A reduction of two carrier operators per shift.
2. An increase in normal grinding capacity of 10%.
3. An increase in extraction of at least 0.5%, with a decrease in maceration water.
4. Elimination of chokes at knives, shredder and crusher.
5. Improvement of shredder operation and cane preparation.

It is anticipated that the cost of the AUTOCANE equipment and its installation will be paid for in tangible savings in a little over two Louisiana grinding seasons.

EDWARDS ENGINEERING CORP.
POWER UNIT FOR MARK III
AUTOCANE



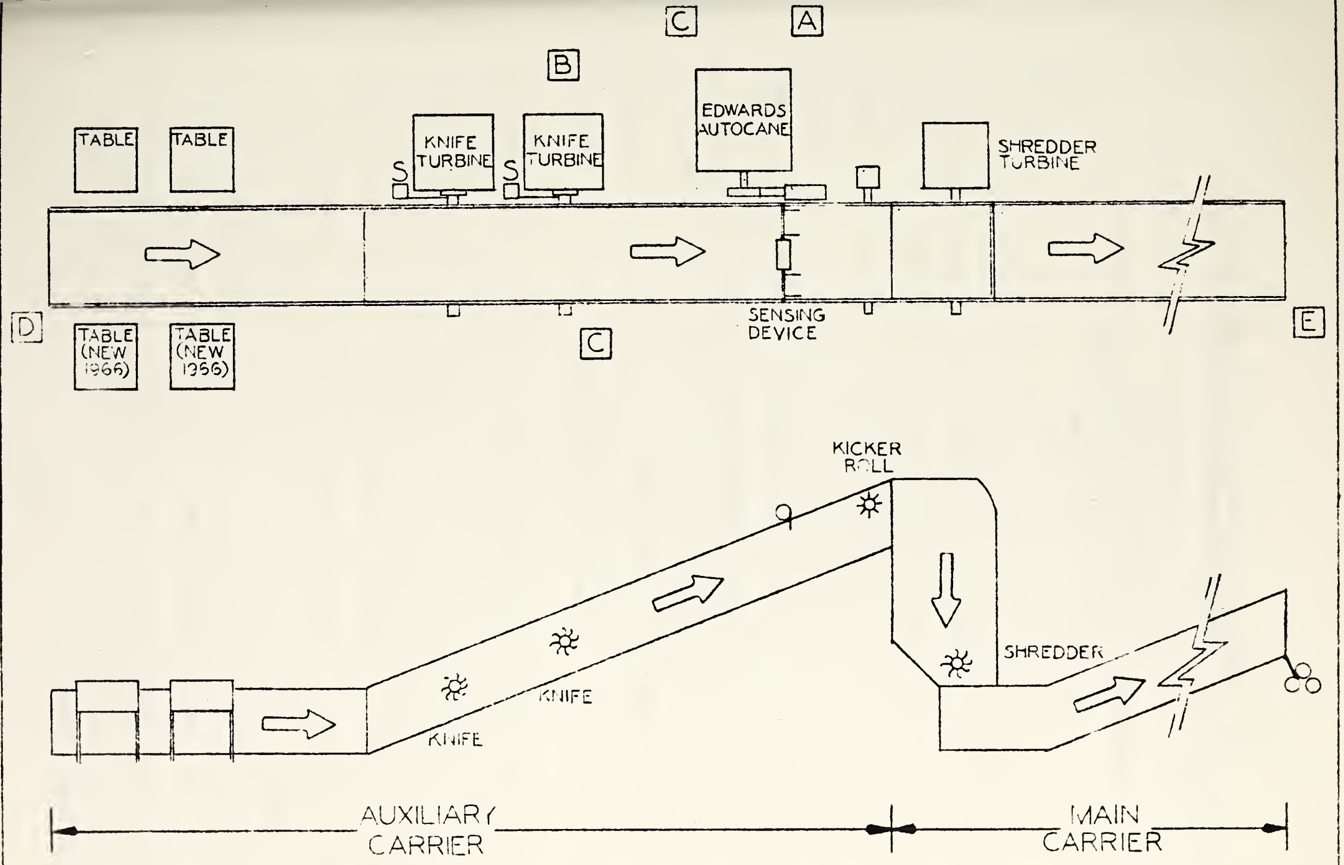


FIG. 2

CANE CONVEYOR INSTALLATION
VALENTINE SUGAR FACTORY
LOCKPORT, LOUISIANA

THE SUGAR ACT AS A FARM POLICY AND ITS EFFECT ON SUGARCANE GROWERS AND CONSUMERS

Fred H. Tyner
Assistant Professor
Department of Agricultural Economics and Agribusiness
Louisiana State University
Baton Rouge

As the title of this paper indicates, there are several points to consider in analyzing the Sugar Act. As a farm policy the Sugar legislation is unique because of the length of time it has been in operation, the success it has achieved, and the lack of public controversy it has aroused. These favorable statements can be made because of the feeling that: (1) the Sugar Acts have had a beneficial effect on the growers of sugarcane and the sugar industry, and (2) consumers have benefitted from the sugar program. This last item attains great importance when the declining ratio of rural-to-urban-oriented legislators is considered.

History of the Sugar Act

The first Sugar Act was passed in 1934, and embodied three major objectives: (1) to maintain a healthy domestic industry of limited size, (2) to promote our general export trade, and (3) to assure adequate supplies of sugar to consumers at reasonable and stable prices. This Act was the culmination of 145 years of Congressional actions and decisions affecting the sugar industry. The following is a brief review of this 145 year history.

In 1789, a tariff was imposed on raw sugar as a means of raising revenue to support our newly formed government. At this time, import duties and domestic excise taxes were the principal sources of government receipts, and the sugar tariff accounted for about 20 per cent of the monies collected through import duties.

Louisiana became a U.S. Territory in 1803, and its sugarcane growers were afforded considerable market protection by the tariff. The Reciprocal Treaty of 1876 between the U. S. and the Kingdom of Hawaii gave the same advantage to Hawaiian producers, so that by 1890 the production of sugar had become Hawaii's most important industry.

In 1890, because of a surplus in the Treasury, the revenue-producing tariff was repealed. Cost to consumers was reduced (the duty at time of repeal was 2½¢ per pound) but tariff protection to growers was also removed. Consequently a bounty of 2 cents per pound was authorized to be paid on domestically produced sugar to continue protection to growers. The international effect of this tariff repeal was to stimulate production in Cuba and, consequently, seriously disadvantage the Hawaiian sugar industry.

In 1894 the bounty was discontinued and a new tariff levied. The purpose of the new tariff was not so much to raise revenue, but was primarily for protection of the domestic sugar industry. This tariff remained in effect until 1934, when the Sugar Act was passed.

Major developments of the 1894-1934 period included the extension of free trade provisions to Puerto Rico and the Philippine Islands and a preferred status to Cuba. Conditions during World War I caused rigid controls to be placed on sugar. With the end of the war and the lifting of these restrictions, the world price of sugar jumped to 19 cents in May of 1920 and fell to less than 5 cents by the end of that same year. Outside of slight price rises for short periods the general trend of sugar prices for the next 12 years was down, particularly from 1929-1933.

During the early part of 1933 the U. S. Tariff Commission recommended a program emphasizing supply controls rather than the traditional tariff

method of assistance. The basis for this recommendation was the failure of the tariff to provide sufficiently high prices for either American or Cuban producers.

In 1933, representatives of the sugar industry met to work out a solution under the provisions of the 1933 Agricultural Adjustment Act. This Act did not designate sugar as a "basic" commodity, but did provide for voluntary marketing agreements. Attempts at a solution of the sugar price problem were towards restricting sales under this voluntary marketing agreements provision. After a summer of heated discussions a plan was submitted to the Secretary of Agriculture for his approval. This plan, which was called the Stabilization Agreement, was designated to: (1) fix minimum prices for raw sugar, (2) limit imports and allocate these imports on a quota system, (3) limit production in each domestic area, and (4) prohibit unfair methods of competition. The Secretary's conclusion was that the plan was unworkable, so the agreement did not go into effect. Although the Stabilization Agreement was not adopted, the time spent in drawing up the agreement was not wasted. The sugar industry had, for the first time, gotten together for a discussion of mutual problems, and thus paved the way for the Jones-Costigan Act of 1934.

The Jones-Costigan (or Sugar) Act was passed on May 9, 1934, and contained six principal means for dealing with the sugar problem. These were:

1. the determination each year of the quantity of sugar needed, at prices reasonable to consumers and fair to producers,
2. the division of the U. S. sugar market among the domestic and foreign supplying areas by the use of quotas,
3. the allotment of these quotas among the various processors in each area.

4. the adjustment of production in each area to the established quotas,
5. the levying of a tax on the processing of sugarcane and sugar beets, with the proceeds to be used to make payments to producers to compensate them for adjusting their production to marketing quotas and to augment their income, and
6. the equitable division of sugar returns among beet and cane processors, growers, and farm workers.

Succeeding sugar legislation has maintained the basic philosophy of the Jones-Costigan Act. The 1934 Act was superseded by the Sugar Acts of 1937 and 1948. The 1948 Act as amended in 1951, 1956, 1960, 1961, 1962, and 1965 encompasses sugar legislation in force at present. A brief look at the provisions of the 1965 Food and Agriculture Act illustrates how well the basic philosophy of the Jones-Costigan Act has been adhered to:

1. Each year the quantity of sugar needed to supply the nation's requirements at prices reasonable to consumers and fair to domestic producers is determined, and adjusted as necessary.
2. Total requirements are next divided by statutory formula among domestic and foreign supplying areas by quotas and limitations on offshore direct consumption sugar.
3. The allotment, when necessary, of these sugar marketing quotas among the various processors in each domestic area.
4. Adjustment of production in each domestic area to the established quotas and appropriate inventory requirements through sugar crop limits applied to each farm.

5. Compensation to growers for adjusting production and as a means of augmenting their incomes.

6. The equitable division of sugar returns among beet and cane processors, growers, and farm workers.

This summarization of the history of sugar legislation shows the evolution of sugar legislation from a producer or revenue for the Treasury to a means of providing adequate supplies of sugar to consumers while attempting to protect the domestic sugar producer. The next two sections will consider the effects of sugar legislation on these growers and on consumers.

Effects on Sugarcane Growers

The gross income of sugarcane growers has increased substantially since the program began in 1934. This larger gross income reflects the influence of generally higher and more stable prices, and also an increase in the growers' share of sugar returns. In Louisiana, from 1936-40, the growers share averaged about 58 per cent of raw sugar returns. By 1951, the share had risen to 67 per cent of the proceeds from raw sugar sales.

The domestic grower benefits from the fact that prices are higher here than in the world sugar market, resulting from the "quota premium" and the tariff. Additionally, the U. S. grower receives a direct payment averaging 0.7 cent per pound which is financed by an excise tax of 0.5 cent per pound on all sugar, whether domestically produced or imported. Thus, there is in total a substantial price and payment incentive to the domestic grower. Returns per ton of sugar beets and sugarcane have held relatively stable over the last 10 years, while prices of other farm products have generally moved to lower levels.

When the sugar program became effective in 1934, our mainland cane and beet producers were supplying only 28 per cent of the domestic market. Today the mainland produces 41 per cent of our needs, with the domestic areas of Hawaii, Puerto Rico and the Virgin Islands supplying an additional 18 per cent of our market.

A single, broad, statement about the Sugar Act would have to indicate that the Act and its administration have worked smoothly. The Act was set up to help domestic producers and to further our foreign relations policy. As conditions change, it is necessary that changes be made, still keeping in mind the broad scope of the Sugar Act.

Recent circumstances that point towards changes are the relaxation of acreage restrictions on sugar beets early in 1967, and the increasing production potential of mainland sugarcane. Apparently the ability of sugarcane growers to produce is outstripping the domestic producers' share of the market. Some recent data on production and quotas for mainland sugarcane are given in the following table:

Cane Sugar Production and Adjusted Quotas for the Continental United States, 1960-1965.

Year	Production	Basic quotas, adjusted	Ratio of quotas to production
	--(1,000 tons, raw value)--		--(Per cent)--
1960	630	774	123
1961	858	715	83
1962	852	795	93
1963	1,183	1,010	85
1964	1,147	911	79
1965	1,104	1,100	100

Source: Sugar Reports, September 1966, pp. 29 and 33.

In his statement to Secretary Freeman last week,[1] Mr. W. S. Chadwick, President of the American Sugar Cane League, pointed out that, under better weather conditions than Louisiana has experienced over the last three years, it would have been necessary to either raise the mainland cane quota or cut back on acreage. In view of increasing labor costs, a decrease in acreage would have had an undesirable effect on sugarcane producers.

Effects on Consumers

What has been the effect of the Sugar Acts on the consumers of sugar? In his remarks to the House of Representatives on September 8, 1966, the Honorable Harold Cooley of North Carolina pointed to the American housewife as "the greatest beneficiary of the sugar program."

The price of sugar in the U.S. is lower than in most every country that does not produce its own total sugar needs. On January 1, 1966, for example, the U.S. retail price of sugar was 11.8 cents per pound. In France the price was 12.6 cents; in Italy 17.4 cents; in Japan 17 cents; in West Germany 13.9 cents; and in the Netherlands 14.4 cents. Because of their sugar arrangements with the Commonwealth nations, the price in the United Kingdom was the lowest, at 9.5 cents.

The sugar program has assured the consumer of a constant and adequate supply of sugar. At the same time, the price of sugar has increased by only 26 per cent in the last 18 years, whereas the cost of all food in the U.S. has increased by 35 per cent. During the first eight months of 1966, a comparison of the prices of six selected ingredients in sugar

---

[1]Statement to Secretary of Agriculture by W. S. Chadwick, Regional Farm Policy Conference, Alexandria, Louisiana, May 22, 1967.

containing products showed that sugar prices have risen less since 1935-39 than the prices of cocoa, peanuts, wheat flour, milk and dextrose.

Sugar Act Administrative Procedure

The preceding descriptions of Sugar Act history and effects should logically include a brief look at current administrative procedures affecting domestic sugar production.

In implementing the intent of the Sugar Act, the Secretary of Agriculture is required to determine, between October 1 and December 31, how much sugar will be needed by consumers in the continental United States during the next calendar year. He takes into consideration the amount of sugar used during the preceding 12 months, the current sugar inventory, and prospective changes in population and demand conditions. Finally, he must estimate the next year's sugar price and index of prices paid by farmers in order to set a requirement figure that will not result in excessively high or low sugar prices.

The next step is dividing the required quantity among domestic and foreign producers. This allocation is made by statutory formula, which currently assigns a basic quota of 6,390,000 tons (raw value) to the five domestic producing areas. The domestic quota is adjustable upward if the Secretary's estimate of requirements exceeds 10.4 million tons, and downward if requirements are less than 9.7 million tons. For the 1966 requirements estimate of 9.8 million tons, the quotas for domestic beets and mainland cane were 3,025,000 tons and 1,100,000 tons, respectively.

In order to implement other objectives of the Sugar Act, the Secretary is required to set marketing allotments on processors and

assign proportionate shares to individual farms where it is felt necessary.

Program Effects in Perspective

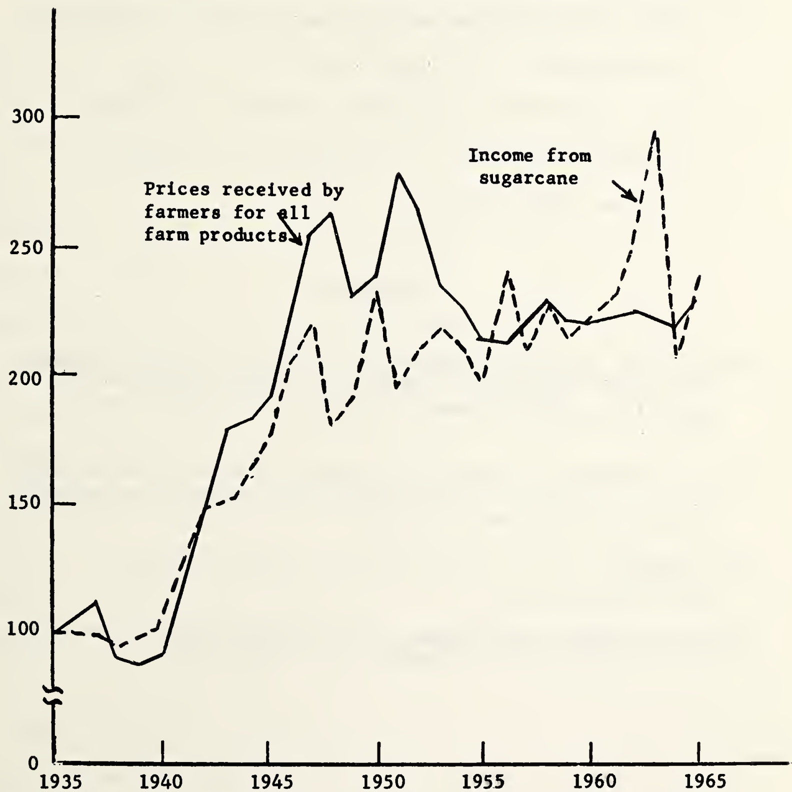
The program for sugar has received little public attention outside the areas of concentrated sugar production because adequate supplies of sugar have been maintained and because there have been no surpluses, such as has been the case with cotton, wheat, and feed grains.

Because of the protection afforded by the Sugar Act, the domestic sugar industry is a growing and thriving part of our economy. Almost 40,000 domestic farms grow sugarcane or beets. About 230,000 farm workers gain seasonal employment in the cultivation and harvesting of these crops. Approximately 62,000 workers are employed in 110 raw cane sugar mills, 61 beet sugar factories, and 29 sugar refineries in the United States. The program directly helps assure sugarbeet and cane processors, growers, and farm and factory workers a fair income from the U.S. sugar market. The accompanying chart shows the relations between prices received by farmers for all farm products and grower's income from sugarcane, 1935 through 1965.

The sugar program also promotes and strengthens our international trade position. Over 30 foreign countries with which the U.S. has diplomatic relations share in the U.S. sugar market, giving them dollars with which to buy other goods from us.

We have covered the functioning of the sugar program, and have looked briefly at the effect this legislation has had on domestic producers and consumers. Those of you who followed the process of amending

Comparison of Prices Received by Farmers and Growers' Income from Sugarcane, 1935-1965



Source: Sugar Reports, U.S. Department of Agriculture, September 1966, p. 39.

the Sugar Act in 1965 know that the margin of victory for the sugar industry was slim. If you, as members of the sugar industry, wish to see that the balance of legislative support does not shift, I would encourage you to do three things:

1. Let your Congressmen know your feelings about the Sugar Act.
2. Assist the groups that represent your industry in furthering the objectives of the sugar industry.
3. Help to publicize the benefits to consumers of a stable, adequate sugar supply, as is made possible by a well-organized sugar program.

References

1. Special Study on Sugar, Report of the Special Study Group on Sugar of the U.S. Department of Agriculture, Senate Committee on Agriculture, 87th Congress, 1st Session, Washington, D. C., February 14, 1961.

2. "Sugar: A Triumph of Good Sense," Remarks by Representative Harold D. Cooley, North Carolina, Congressional Record, 89th Congress, 2nd Session, September 8, 1966.

3. Sugar Reports, U.S.D.A., Washington, D. C.,March 1966 and September 1966 issue.

4. The United States Sugar Program, Agricultural Information Bulletin No. 111, U.S.D.A., Washington, D. C., July 1953.

WHAT LOUISIANA RAW SUGAR MILLS CAN DO TO IMPROVE THE QUALITY OF THEIR RAW SUGAR

J. N. Foret
The South Coast Corporation
Georgia Division
Mathews, Louisiana

There are six important specification values which effect the improvement of the quality of raw sugar from Louisiana mills. They are: 1) Temperature, 2) Moisture, 3) Grain size, 4) Ash, 5) Filterability, and 6) Invert.

1. Temperature: The temperature of raw sugar may not affect all mills; however, in our case, being a refinery that stores the raw sugar from company-owned raw mills, it is very important to keep the raw sugar produced at 100°F or less. The color of the raw sugar will increase if the temperature is not kept at this level. Fowler and Kopfler found that raw sugar stored for seven months at 32°F showed practically no darkening, whereas the same sugar stored at 127°F increased 400 to 500 percent in color. Also, hot raws will tend to invert when placed in warehouses for storage for any length of time. We can cool the sugar when it leaves the centrifugals by blowing air as it is conveyed to the warehouse. Another important point to remember is to have proper supervision while distributing your raws on the warehouse floor. By all means don't let your slinger or conveyor keep dropping the raw sugar in the same location. You should spread the sugar as thinly as possible to give it a chance to cool. A fan or blower can be placed near your slinger or belt conveyor to blow cool air through the sugar while it is being slung or dropped. At our Raceland mill, where we have a very large warehouse, we store sugar in small piles along the walls and go the next day and sling the sugar to the main storage area.

2. Moisture: The most important condition necessary to store raw sugar with a minimum of deterioration involves the control of moisture, or the "Safety Factor." The formula for it is $\frac{\text{moisture}}{100 - \text{polarization}}$ = Safety Factor. Many authorities believe that .333 or less is safe; however, we believe that this safety factor is too high and should be .280 or less. We can achieve the above by boiling in our pans a uniform, well-formed grain of fair size, which will purge more freely in the centrifugals. The larger grains of sugar will absorb less moisture during storage, whereas conglomerates, or grain clusters, will hold more moisture. Another important feature in reducing moisture is to have proper supervision and good operators at the centrifugal station. We have already seen an operator adding a little water to his centrifugal basket (stopped) to make the sugar easier to cut. As mentioned to you under 1. Temperature, you should blow air over the sugar while it is being conveyed, because that will also help to dry the sugar as well as cool it.

3. Grain Size: We believe that if the raw sugar mill produced a uniform, large grain of sugar, it would automatically eliminate many of its other problems. This can be accomplished by good pan boiling with the necessary number of pans. Pan circulators will also improve the crystal formation in all strikes of sugar. Our Raceland mill, with a minimum pan capacity, in the 1966 grinding season, was able to meet all grain specifications by melting approximately 50% of its crystallizer sugar. This melted sugar can be pumped to a separate tank or mixed with the syrup. By using two seeders, better use of pans can be accomplished--one seeder for grain for crystallizer strikes and the other for cutting pans. All of us here realize that the 1966 crop gave us a juice of higher

purity than the two previous years. However, we would like to state that the Little Texas Mill, during the grinding season of 1965, made sugar to meet the grain specification. As everyone here knows, this was after "Betsy"; and our purities were very low. They accomplished this by melting most of their crystallizer sugar.

4. Ash: In Louisiana we are blessed with good soil; therefore, our problems with ash are negligible. However, if any mill should have any trouble with ash, it can be reduced by making a uniform grain and applying a little more wash water to its centrifugals. Nevertheless, there are some sugars in which the ash is in the crystal; and more wash water will not remove the ash. This year at our Georgia Refinery we received this type of raw sugar.

5. Filterability: We believe that to improve the filterability of raw sugar, all cane should be washed. Some sugar is lost in the wash water, but this is made up by better grinding rates and less process losses. Good clarification is of prime importance for sugar of good filterability. Therefore, you should have good capacity at the clarifier station. We have also found that by using the belt filters for our muds, we produced a raw sugar of better filterability. Our experience in Louisiana has proven that a large uniform grain of raw sugar will also help this factor.

6. Invert: There are a number of things that can be done to prevent the invert in raw sugar. Sugar cane is cultivated in Louisiana where the climate is not ideal. The effective growing period for the cane is approximately 8 to 9 months. Therefore, when it is harvested it is not matured, as compared to cane grown in warmer climates. With this knowledge,

we should try to get only fresh-cut cane to the mills. They cannot remove the invert after it has been formed in old burnt cane. Besides, all mills should practice mill sanitation. High pressure hot water should be used to clean under the rollers. The use of modern bacteriostatic compounds such as Busan and Drew Biocide 280 will help to reduce the invert in raw sugar. Installing belt filters, which allow you to send your juices directly to the evaporators, will help to reduce the invert as well. As all of you know, the juices from the old type rotary vacuum filters are still recycled to the clarifier. Proper control of pH in clarification and control of recirculation of molasses will also reduce the invert in raw sugar. Besides, it is advisable to wash the raw sugar a little in the high grade centrifugals. We know that it is the practice in some Louisiana mills not to wash the sugar; however, we do not agree with this procedure.

In conclusion, we would like to say that after many years of experience, we have found that a bad plant run by good men is preferable to a good plant run by bad men. We strongly recommend proper supervision of these six specification values to improve the quality of raw sugar from Louisiana mills: Temperature, Moisture, Grain Size, Ash, Filterability, and Invert.

SUMMARY, ANNUAL MEETING

AMERICAN SOCIETY OF SUGARCANE TECHNOLOGISTS

February 2, 1967

The Annual Meeting of the American Society of Sugar Cane Technologists was held on Thursday, February 2, 1967, at the Lakeshore Motor Hotel, Baton Rouge, Louisiana.

The meeting was called to order by President Paul Cancienne. He acknowledged the excellent attendance and made several announcements concerning registration and the banquet.

President Cancienne presented John William Barker, Chairman of the Agricultural Section, who in turn introduced the following program:

Soybean Production in the Louisiana Sugarcane Area	Dr. L. L. McCormick L.S.U. Cooperative Extension Service
Effect of an Early Freeze on Louisiana Sugarcane	Dr. James Irvine Physiologist, USDA Houma, Louisiana
A Panel: Three Ways to Reduce Field Labor Requirements	Moderator: G. J. Durbin American Sugar Cane League New Orleans, Louisiana
(1) By Use of Multi-Row Equipment	Eugene Graugnard St. James, Louisiana
(2) By Land Grading	C. H. Burleigh Houma, Louisiana
(3) By Airplane Application of Herbicides	D. C. Mattingly Belle Rose, Louisiana

At the conclusion of this sectional program, President Cancienne called to order a business session. The following actions were taken:

(1) Mr. Tom Allen, Chairman of a special committee to nominate members to Honorary Membership, proposed the following names:

1. H. J. Jacobs

2. Anatole Keller

3. E. W. McNeil

4. George P. Meade

5. Horace Nelson

The five named members were unanimously approved.

(2) A brief moment of silence was called for in memory of Stanley Alexandry, Sam Pertuit and Ridley LeBlanc, members of our Society who passed away during 1966.

(3) The financial status of our society was discussed by Denver T. Loupe, Secretary-Treasurer. The financial statement as distributed was approved.

(4) A report from Clay Terry about the NCAAA Meeting stated that eleven Extension Agents from the Louisiana Sugarcane Parishes went to Hawaii and in addition to attending their annual meeting, had an opportunity to visit the Hawaiian Sugar Industry. E. J. Burleigh, County Agent, Iberville Parish, on behalf of the agents attending, thanked the Society for their assistance.

The meeting was recessed for lunch.

At 2:05 p.m., President Cancienne convened the afternoon session. He introduced J. A. "Pete" Dornier, Chairman of the Manufacturing Section, who in turn presented the following program:

Operation of Edwards Autocane System, Valentine Factory, 1966	F. L. Barker, Jr. Lockport, Louisiana, and H. P. Dorman Edwards Engineering Co.
Mechanized Feed Table	Camp Matens Thompson Machinery Co. Thibodaux, Louisiana

Mechanical Seals for Sugar Mill Service	John Copes C. S. Seal Company
Mobility in Cane Transfer Loading	J. P. Thomas J. P. Thomas & Sons, Inc.

The Meeting was then adjourned.

The Annual Banquet got underway at 6:35 p.m. Invocation was given by Frank L. Barker, Jr. Past Presidents of the Society were introduced. Section Chairmen presented certificates to the program participants. Paul Cancienne presented certificates to the Honorary Members. Recognition of special guests was followed by the introduction of Commissioner Dave L. Pearce, Department of Agriculture and Immigration, who delivered the banquet address.

President Cancienne presented Thomas Allen, in-coming President, who then presented the following 1967 officers:

Clay Terry -- First Vice-President

J. A. Dornier, Jr. -- Second Vice-President

Denver T. Loupe-- Secretary-Treasurer

Minus Granger -- Chairman, Agricultural Section

Connie Melancon -- Chairman, Manufacturing Section

Frank L. Barker, Jr. -- Chairman-at-Large

Adjournment came at 8:05 p.m.

Respectfully submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

SUMMARY, SUMMER MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

June 1, 1967

The Summer Meeting of the American Society of Sugar Cane Technologists was held on Thursday, June 1, 1967, at Francis T. Nicholls State College, Thibodaux, Louisiana.

The meeting was called to order by President Thomas Allen. Mr. Warren J. Harang, Jr., Mayor, City of Thibodaux, welcomed the group. President Allen expressed appreciation to the College personnel for the use of the Nicholls facilities for our summer meeting.

President Allen introduced Minus Granger, Chairman of the Agricultural Section who in turn presented the following program:

The Sugar Act	Fred H. Tyner, Asst. Prof., Dept. of Ag. Eco. and Agribusiness Louisiana State University
Physiology of Sugar Cane	James Irvine, Physiologist USDA Sugar Cane Station Houma, Louisiana

President Allen introduced Connie Melancon, Chairman of the Manufacturing Section who in turn presented the following program:

Raw Sugar Quality	Bill Domingues and Tom Pierson, of American Sugars
What Louisiana Raw Sugar Mills Can Do to Improve the Quality of Their Raw Sugar	J. N. Foret The South Coast Corporation Georgia Division Mathews, Louisiana

There followed a brief business session at which time certain proposals were acted upon:

1) That Denver T. Loupe, A.S.S.C.T. Secretary-Treasurer and also Regional Vice-Chairman of the I.S.S.C.T. would officially represent the A.S.S.C.T. at the XIII Congress in Taiwan. Motion made by Horace Nelson, seconded by F. Evans Farwell and unanimously approved.

2) That a Special Committee had been appointed and that this committee would study the feasibility of inviting the XIV Congress I.S.S.C.T. to Louisiana for 1971.

3) Announced proposal for presentation of special awards to all living past Presidents and Secretary-Treasurers of the Society at the annual meeting scheduled for Feb. 1, 1968.

4) President Allen again thanked officials of Nicholls State College for hosting the Society's summer meeting.

5) Meeting adjourned at 12:25 p.m. to re-convene at American Legion Building for lunch.

Respectfully submitted,

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 15 - Papers for 1968

December, 1968

PROCEEDINGS

American Society of Sugar Cane Technologists

Volume 15 - Papers for 1968

December, 1968

FOREWORD

This is the fifteenth volume of Proceedings of the Society which has been published since its founding in 1938.

The first volume published in 1941 included papers presented during 1938, 1939 and 1940. Mr. Walter Godchaux, Jr., the then Secretary-Treasurer, edited that edition.

The second volume published in 1946 included papers presented during 1941-1945 inclusive. Dr. E. V. Abbott, Secretary-Treasurer, edited that edition.

The third volume published in 1953 included papers presented during 1946-1950 inclusive. A fourth volume was published in 1955 and presented papers for the years 1950 through 1953. Volume five contains papers for the years 1954 and 1955. The sixth volume included papers presented during 1956. The third through the sixth volumes were edited by Dr. Arthur G. Keller.

The seventh volume, which is in two parts, 7A and 7B, contains papers presented during 1957 through 1960 inclusive. The eighth, ninth, tenth, eleventh, twelfth, thirteenth and fourteenth volumes contain papers presented during 1961, 1962, 1963, 1964, 1965, 1966, and 1967 respectively. These volumes, as well as this, the fifteenth volume, which includes papers for the year 1968, have been compiled by the writer.

Denver T. Loupe

Denver T. Loupe
Secretary-Treasurer

December, 1968

INDEX

APPLICATION OF THE TWO BOILING SYSTEM TO LOUISIANA

T. R. Ray
T. R. Ray, Inc., Baton Rouge, Louisiana

The imposition of penalties for poor quality raw sugar in Louisiana has brought about several articles in the technical journals on possible ways of improving sugar quality. The recent articles have concerned the need for better clarification, more even and larger grain size, better centrifugal work, etc. Surprisingly enough, nothing has appeared concerning the use of the two boiling system in Louisiana. The use of the two boiling system in Louisiana is probably the easiest and the quickest way to improve sugar quality. This article will briefly review the possible application of the two boiling system to Louisiana. Calculations using typical laboratory results for a Louisiana factory are given to illustrate the results to be expected.

What is the two boiling system? The new two boiling system, sometimes referred to as the "A-C" system, is the newest of the major boiling systems developed. "A" massecuites are boiled using all the "C" sugar either as footing or as meted feed and using all the syrup. No "B" strike is produced. Grain for "C" strike is made on "A" molasses. "C" strikes are finished with "A" molasses only. The result is a system which produces all its commercial sugar from high purity "A" strikes.

There are many advantages of the two boiling system over the conventional three boiling system in general use in Louisiana. All the commercial sugar comes from high purity "A" strikes and is, therefore, much better in quality than the mixture of "A" and "B" sugar produced from the three boiling system. The "B" strike is eliminated and this naturally improves the high grade centrifugal work since the centrifugals never have to handle a

poor purging "B" strike. The elimination of the "B" strike simplifies the whole pan floor procedure. The resulting system used on the pan floor is less subject to error by the pan boilers and is inherently more flexible. Less total massecuite is boiled with the two boiling system which results in much more pan and high grade centrifugal capacity. Grain is made on "A" molasses and this usually means better quality "C" grain and consequently easier purging "C" massecuite. Grain made with full pan seeding on "A" molasses is inherently more uniform and standard in size than grain made with the conventional methods used with syrup graining in Louisiana. There is no reboiling of lower purity molasses into higher purity massecuite. This reduced boiling of the molasses means that there is less chance for destruction of sugar in the pans. In the three boiling system, "A" molasses of 55 to 57 purity is boiled back to a 67 to 69 purity "B" strike and "B" molasses of 45 to 48 purity is boiled back to a 56 to 58 purity "C" strike. Since the molasses used in producing these strikes are of lower purity than the purity of the strikes themselves, there is considerable wasted work in reducing the purity of the syrup to that of the final molasses. Furthermore, it is common practice in Louisiana to grain on syrup, but this syrup at approximately 78 to 79 purity is not used for making high purity sugar. It is used for producing a low purity "C" sugar which then must be recircled. In a sense then, the high purity of the syrup is lost when used to make "C" strikes. The two boiling system reduces considerably the total massecuite boiled and this in turn means a considerable reduction in steam consumption on the pan floor. Ordinarily, this would be considered an advantage. However, some factories in Louisiana may find it a distinct disadvantage. Some factories have a tremendous surplus of bagasse and go to considerable expense to remove it. Use of the two boiling system at those factories would mean

more expense for removing the greater excess bagasse. Conversely, there are some factories which sell their bagasse and must use natural gas for producing all their steam. These factories would find a reduced steam consumption on the pan floor a great advantage.

It is easier to see the comparison between the two and three boiling systems as applied in Louisiana, if a specific example is considered. Calculations of the results to be obtained from both the two and three boiling systems were made using typical laboratory data from a Louisiana factory.

The laboratory data upon which the calculations are based are given in Table I. Tables II, III, and IV show the quantities of the various materials required to produce each strike and the produces of each strike for the three boiling system and for two variations of the two boiling system. These three tables are based on 10,000# of syrup solids. The quantities given therein can easily be changed into percentages of syrup solids by moving the decimal point two places to the left.

The three boiling system needs no explanation. The two boiling system Case 1 assumes that no attempt will be made to maintain fixed purities for either the "A" or the "C" strikes. The "A" strikes take all the syrup and "C" sugar with no boiling back of "A" molasses. The purity of the strike is allowed to fall where it will. Grain is made in the "A" molasses as it comes from the "A" strike and the "C" strike is finished on "A" molasses alone. The purity of the "C" strike is, therefore, exactly identical to the purity of the "A" molasses. This is the boiling system considered best for the Louisiana factories. Case 2 assumes that all "C" strikes will be boiled to a fixed 60 apparent purity. Case 2 will be further explained later.

Table V shows the amount of massecuite produced by the various boiling systems at a grinding rate of 4,200 short tons of cane per day. It also gives a comparison of the average pan floor steam consumption. The reduction in massecuite boiled, as well as the reduction in steam consumption, in the two boiling system Case 1 as compared to the three boiling system is evident.

One very important point to note in studying Tables II and III is the source of the commercial sugar. Less than 60% of the sugar from the three boiling system is produced by the "A" strike. The remainder is produced from a 67 to 69 purity "B" strike. In the two boiling system, all the sugar is produced from an 80 purity "A" strike. Separation of the sugar crystals from the molasses in the centrifugals is much easier with the two boiling system. Consequently, the quality of the commercial sugar produced with the two boiling system is much better. It is to be expected that pol, moisture, ash, color, and filterability of the raw sugar will be improved. For those factories which still use slow speed belt driven centrifugals for purging "A" and "B" strikes, the change to the two boiling system may cause a dramatic improvement in sugar quality.

There are several misconceptions about the two boiling system which should be cleared up.

1. Do not confuse the new "A-C" two boiling system with the old two boiling system. The old two boiling system used syrup grain and boiled back "A" molasses in the "A" strikes to a fixed 72 "A" strike purity. The old two boiling system was never favorably received. It has since been almost entirely superseded, either by the standard three boiling system or by the new "A-C" two boiling system.

2. It is generally thought that the use of a two boiling system means that a large amount of "C" sugar must be melted because it will not

be required as footings for the "A" strikes. This will not be true of the two boiling system in Louisiana. Table V shows that for both the two boiling system Case 1 and the three boiling system, the amount of "C" strikes and "C" sugar produced is almost the same. The need to melt "C" sugar would, therefore, not be any greater for the two boiling system than it is for the three boiling system. However, it should be pointed out that a large grain raw sugar can only be made by melting sugar. This is true whether the system used be a three boiling or a two boiling system. The amount of "C" sugar melted, however, is more dependent upon the size of grain desired in the commercial sugar than upon the use of either of the boiling systems.

3. It is commonly thought that more "C" strikes will be produced and that this will tax the crystallizers and the low grade centrifugals. It is clearly shown by the calculations that the amount of "C" strikes which will be produced in Louisiana are practically identical whether the three or the two boiling system is used.

4. It is sometimes stated that the use of the two boiling system is difficult because the low grade pans will be swamped with a large amount of "A" molasses. It is true that since all commercial sugar is made from "A" strikes, there will be more "A" molasses produced with the two boiling system than is now produced with the three boiling system. However, since the "B" strikes and "B" molasses are eliminated and since syrup is not used in the "C" strike, the load upon the low grade pans remains about the same. Actually, the only load on the "C" pans will be the "A" molasses. Comparison of Tables II and III will readily point out that the amount of solids handled by the low grade pans will be approximately the same whether the two boiling or the three boiling system is used.

5. It seems to be an article of faith among pan boilers that it is extremely difficult to grain on "A" molasses. Actually, if the same method is used for graining "A" molasses as is generally used in Louisiana for graining syrup, then it is practically impossible to grain on "A" molasses. In order to do a good job of graining "A" molasses, full pan seeding is required, and the vacuum pan must be equipped with the necessary instruments and controls. The method of full pan seeding greatly simplifies the problem of graining and the use of a supersaturation indicator eliminates the guesswork in judging the proper time to introduce the seed into the pan. The supersaturation indicator also will be extremely useful in preventing the formation of false grain and conglomerates after the seed has been introduced to the pan. If the proper technique is used, the pan boilers will find that it is easier to grain on "A" molasses with full seeding than it is to produce grain on syrup using the commonly accepted methods. Grain will be much more uniform and this by itself will greatly improve the pan work and the quality of the sugar. Of course, it must be pointed out that full pan seeding can also be done on syrup when the three boiling system is used. It is strongly advised that if the reader considers the use of the three boiling system best for his factory, then full pan seeding on syrup should be instituted in order to obtain the advantages of more uniform grain.

There is one important modification of the standard two boiling system which will be of interest in Louisiana. As used in the tropics, the two boiling system requires that grain be made on "A" molasses. This is necessary because syrup purities of 83 to 84 are typical of the tropics and the resulting "A" molasses purity is usually 63 to 64. Since the "C" strikes must be held to 63 to 64 purity in order to obtain a low purity

final molasses, there is no alternative but to grain on "A" molasses. In Louisiana, where syrup purities of 78 to 79 are common, it would be possible to grain on syrup. This would increase the purity of the "C" strike slightly but would probably not mean any increase in the purity of the final molasses. In fact, there is some evidence to believe that a properly boiled "C" strike of 60 to 61 purity in Louisiana may result in a final molasses of the same, or lower, purity than can be obtained from a 56 purity "C" strike.

Because of the opposition among pan boilers in Louisiana to graining on "A" molasses, some fabrication superintendents may desire to grain on syrup. Grain could be farmed exactly as formed at the present time, or by full seeding of the syrup. As soon as the grain has been brought together in the pan, (usually when the pan is about half full) the pan could be put on "A" molasses. The grain would be built up to full pan volume on "A" molasses. Two-thirds of the pan contents would be cut to the No. 1 grain storage tank. The remaining one-third in the pan would again be built up to full pan volume on "A" molasses. Two-thirds of the contents would then be sent to the No. 2 grain storage tank and the remaining one-third would be used as a footing for a "C" strike. The "C" strike, of course, would be finished with "A" molasses. With 79 purity syrup and 57 purity "A" molasses, the purity of the resulting "C" strikes would be between 58 and 59.

For those fabrication superintendents who wish to grain on syrup with the two boiling system, Table IV has been prepared. Table IV shows what would happen if the purity of the "C" strike was raised to 60. In this case, a small amount of syrup must be used to make the "C" massecuite which results in an increase in the amount of "C" massecuite and "C" sugar produced. This means that a greater percentage of "C" sugar must be melted

when it is used as footings for the "A" strikes. Nevertheless, most of the advantages of the two boiling system are retained with this modification and it may be easier to apply it to some factories.

This modification was used at Cinclare Central Factory during the 1967 crop and results were generally satisfactory. Table VI shows the comparative results of the 1966 and 1967 crops. The improvements in 1967 are obvious but not solely due to the two boiling system. Favorable climatic conditions during most of the crop plus greatly improved control over boiling house operations undoubtedly contributed to better results. But the increased pol and filterability and reduced ash and color can be expected from a change to the two boiling system.

Since Cinclare has used the two boiling system longer than any other factory in Louisiana, their results should be examined critically. After initial difficulty setting up the new system, very good results were obtained with it until the last week of the crop. At that time, the final molasses purity rose sharply. No adequate explanation has been given for the rise but it is said that the large percentage of immature plant cane may have been the cause. It is also possible that the extremely wet weather and rapidly deteriorating cane quality encountered at that time were important factors. Still, the average final molasses purity for the entire 1967 crop was lower than the 1966 crop.

A few comments concerning the equipment required for proper use of the two boiling system may be desirable. The pan used for graining the "A" molasses should be equipped with a supersaturation indicator, automatic vacuum control, and preferably equipped with a Webre type agitator. The equipment is listed in descending order of importance. The supersaturation indicator is absolutely essential, whereas the Webre agitator is desirable

but not essential. Most factories in Louisiana are short on agitator tanks to be used for storing "C" grain and for magma and "A" footings. Proper operation of any system whether of two boiling or three boiling, would require at least two grain tanks so that the grain for low grade strikes can be built up to a proper size. At least one, and preferably two, "A" footing tanks are required in addition to the tank for storing magma. Some provision must also be made for melting "C" sugar. As mentioned before, melting "C" sugar in Louisiana is more function of the desire to produce a large grain sugar than it is of the use of the two boiling system. Provision for melting the "C" sugar must be made in any case whether the two boiling or the three boiling system is used. Actually, none of the equipment listed above for use with the two boiling system is exclusive to the two boiling system. All of the equipment should be used even with the three boiling system if best results are to be expected.

Probably the biggest disadvantage of introducing the two boiling system will be the inertia and resistance of the operating personnel. Having been accustomed for many years to the standard three boiling system, they will not be eager to see any change, however advantageous the change may be. The many advantages of the two boiling system, however, far outweigh the work and planning required to overcome the inertia and resistance of the pan boilers. The improvement in quality of the commercial sugar is by itself a sufficient reason for introducing the two boiling system. But in addition to the better quality commercial sugar produced with the two boiling system, there are numerous other advantages which should not be forgotten. The elimination of the "B" strike certainly improves high grade centrifugal work and simplifies the whole pan floor procedure. The two boiling system produces less total massecuite than any other system and

this means greatly reduced steam consumption and an increase in vacuum pan and high grade centrifugal capacity. Graining on "A" molasses usually means better quality grain, easier purging "C" massecuite, and possibly lower purity final molasses. All these advantages certainly make the application of the system very desirable for Louisiana.

I would like to express my appreciation to the personnel at Cinclare and particularly Mr. Woodrow P. Sevin, Factory Manager, who supplied the laboratory data given in Table VI and whose constructive criticism was helpful in the preparation of this report.

TABLE I

LABORATORY DATA

	Brix	Pol	Apparent Purity	True Purity
Syrup	53.58	42.24	78.8	83.4
"A" Strike	93.45	74.58	79.8	84.1
"A" Molasses	-	-	55.5	65.0
"B" Strike	95.74	65.98	68.9	75.6
"B" Molasses	-	-	46.9	58.3
"C" Strike	96.54	53.41	55.3	64.9
Final Molasses	80.00	25.22	31.5	46.2
Commercial Sugar	99.50	96.97	-	97.5
"C" Sugar	-	-	83.7	87.2

TABLE II

THREE BOILING SYSTEM

Basis: 10,000# Syrup Solids

	# Solids	# Sucrose	# Non-Sucrose	True Purity	Apparent Purity
"A" Strike					
Syrup	5956	4967	989	83.4	78.8
"C" Sugar Seed	1367	1192	175	87.2	83.7
84.1 True Purity "A" Strike	7323	6159	1164	84.1	79.8
"A" Molasses in "A" Strike	3326	2162	1164	65.0	55.5
100% "A" Sugar in "A" Strike	3997	3997	-	100.0	100.0
Add "A" Molasses to 97.5 True Purity	308	200	108	65.0	55.0
97.5 True Purity "A" Sugar	4305	4197	108	97.5	-
"B" Strike					
"A" Strike	7323	6159	1164	84.1	79.8
Less 97.5 True Purity "A" Sugar	4305	4197	108	97.5	-
"A" Molasses to "B" Strike	3018	1962	1056	65.0	55.5
Add "C" Sugar Seed	935	815	120	87.2	83.7
"A" Molasses and "C" Sugar Seed	3953	2777	1176	70.3	62.2
Add Syrup to 75.6 True Purity	2715	2264	451	83.4	78.8
75.6 True Purity "B" Strike	6668	5041	1627	75.6	68.9
"B" Molasses in "B" Strike	3902	2275	1627	58.3	46.9
100% "B" Sugar in "B" Strike	2766	2766	-	100.0	100.0
Add "B" Molasses to 97.5 True Purity	177	103	74	58.3	46.9
97.5 True Purity "B" Sugar	2943	2869	74	97.5	-

TABLE II - THREE BOILING SYSTEM - (Continued)

	# Solids	# Sucrose	# Non Sucrose	True Purity	Apparent Purity
"C" Strike					
"B" Strike	6668	5041	1627	75.6	68.9
Less 97.5 True Purity "B" Sugar	2943	2869	74	97.5	-
"B" Molasses to "C" Strike	3725	2172	1553	58.3	46.9
Add Syrup to 64.9 True Purity	1326	1106	220	83.4	78.8
64.9 True Purity "C" Strike	5051	3278	1773	64.9	55.3
Less Final Molasses	3296	1523	1773	46.2	31.5
100% "C" Sugar	1755	1755	-	100.0	100.0
Add Final Molasses to 87.2 True Purity	548	253	295	46.2	31.5
87.2 True Purity "C" Sugar	2303	2008	295	87.2	83.7
"C" Strike	5051	3278	1773	64.9	55.3
Less 87.2 True Purity "C" Sugar	2303	2008	295	87.2	83.7
Final Molasses to Storage	2748	1270	1478	46.2	31.5

Syrup Solids Used = 9,997#
Syrup Solids Available = 10,000
Neglected Error = 3#/10,000# = 0.03%

"C" Sugar Solids Used = 2302#
"C" Sugar Solids Produced = 2303
Neglected Error = 1#/2303# = 0.043%

TABLE III

TWO BOILING SYSTEM - CASE 1

Basis: 10,000# Syrup Solids
"C" Strkes of 65.5 True Purity

	# Solids	# Sucrose	# Non-Sucrose	True Purity	Apparent Purity
"A" Strike					
Syrup	10,000	8,340	1660	83.4	78.8
"C" Sugar, Seed and Melt	2,362	2,102	260	89.0	86.0
"A" Strike	12,362	10,442	1920	84.5	80.2
Less "A" Molasses in "A" Strike	5,565	3,645	1920	65.5	56.1
100% "A" Sugar in "A" Strike	6,797	6,797	-	100.0	100.0
Add "A" Molasses to 98.0 True Purity	417	273	144	65.5	56.1
98.0 True Purity "A" Sugar	7,214	7,070	144	98.0	-
"C" Strike					
"A" Strike	12,362	10,442	1920	84.5	80.2
Less 98.0 True Purity "A" Sugar	7,214	7,070	144	98.0	-
"A" Molasses to "C" Strike	5,148	3,372	1776	65.5	56.1
"C" Strike	5,148	3,372	1776	65.5	56.1
Less Final Molasses in "C" Strike	3,265	1,489	1776	45.6	30.8
100% "C" Sugar in "C" Strike	1,833	1,883	-	100.0	100.0
Add Final Molasses to 89.0 True Purity	478	218	260	45.6	30.8
89.0 True Purity "C" Sugar	2,361	2,101	260	89.0	86.0
"C" Strike	5,148	3,372	1776	65.5	56.1
Less 89.0 True Purity "C" Sugar	2,361	2,101	260	89.0	86.0
Final Molasses to Storage	2,787	1,271	1516	45.6	30.8

"C" Sugar Solids Used - 2362
"C" Sugar Solids Produced - 2361
Neglected Error - 1#/2361# = 0.042%

TABLE IV

TWO BOILING SYSTEM - CASE 2

Basis: 10,000# Syrup Solids
"C" Strikes of 68.6 True Purity

	# Solids	# Sucrose	# Non-Sucrose	True Purity	Apparent Purity
"A" Strike					
Syrup	9,138	7,621	1517	83.4	78.8
"C" Sugar, Seed and Melt	2,992	2,693	299	90.0	87.2
"A" Strike	12,130	10,314	1816	85.0	80.9
Less "A" Molasses in "A" Strike	5,341	3,525	1816	66.0	56.7
100% "A" Sugar in "A" Strike	6,789	6,789	-	100.0	100.0
Add "A" Molasses to 98.0 True Purity	425	281	144	66.0	56.7
98.0 True Purity "A" Sugar	7,214	7,070	144	98.0	97.4
"C" Strike					
"A" Strike	12,130	10,314	1816	85.0	80.9
Less 98.0 True Purity "A" Sugar	7,214	7,070	144	98.0	97.4
"A" Molasses to "C" Strike	4,916	3,244	1672	66.0	56.7
Add Syrup to 68.6 True Purity	864	721	143	83.4	78.8
68.6 True Purity "C" Strike	5,780	3,965	1815	68.6	60.0
Less Final Molasses in "C" Strike	3,336	1,521	1815	45.6	30.8
100% "C" Sugar in "C" Strike	2,444	2,444	-	100.0	100.0
Add Final Molasses to 90 True Purity	550	251	299	45.6	30.8
90 True Purity "C" Sugar	2,994	2,695	299	90.0	87.2
"C" Strike	5,780	3,965	1815	68.6	60.0
Less 90 True Purity "C" Sugar	2,944	2,695	299	90.0	87.2
Final Molasses to Storage	2,786	1,270	1516	45.6	30.8

Syrup Solids Used = 10,002#
Syrup Solids Available = 10,000
Neglected Error 2#/10,000# = 0.02%

"C" Sugar Solids Used = 2992#
"C" Sugar Solids Produced 2994
2#/2994# = 0.067%

TABLE V

COMPARISON OF RESULTS

Basis: 4,200 Short Tons Cane Per Day

	Three Boiling System	Two Boiling System Case 1	Two Boiling System Case 2
"A" Strikes, Ft^3/Day	7,646	12,908	12,666
"B" Strikes, Ft^3/Day	6,722	-	-
"C" Strikes, Ft^3/Day	5,031	5,127	5,757
Total Massecuite Produced, Ft^3/Day	19,399	18,035	18,423
Average Pan Floor Steam Consumption, #/Hr.	55,470	49,731	51,144

TABLE VI

COMPARATIVE RESULTS FOR CINCLARE CENTRAL FACTORY

1966 and 1967

	No. 10 Contract Standard	1966	1967*
Boiling System Used	-	Three Boiling	Modified Two Boiling
Daily Average Grinding Rate, Tons	-	2,645	3,001
Pounds 96° Sugar Per Ton of Cane	-	164.11	182.25
Final Molasses Purity	-	31.53	30.40
Sugar			
Polarization	96.00	96.50	97.52
Moisture, %	-	1.06	.74
Safety Factor	.28	.31	.30
Ash, %	-	.54	.43
Ash Contract Maximum	-	.68	.52
Ash Contract Minimum	-	.44	.28
Grain Size	55-20	37.7	43.8
Filterability	50-125	51.00	130
Color	0.21-0.10	0.16	.13

*Sugar analyses for 1967 crop do not include sugar produced during last two weeks of crop. Laboratory results for the sugar produced during this period were not available when the report was written.

AUTOMATED BAGASSE BALE HANDLING

Albert I. Guidry, Chief Engineer
The South Coast Corporation, Houma, Louisiana

Bagasse from Louisiana mills, when sold as a raw material for use in other manufacturing processes in lieu of burning as a fuel source, historically has been compressed into rectangular shaped wire bound bales weighing approximately 300 lbs. in order to facilitate handling and transportation.

It might be well to point out, however, that within the last few years several factories have gone to bulk storage and handling of bagasse.

The South Coast Corporation operates four bagasse baling stations, one at each of our own factories and two other baling stations for The Celotex Corporation. Essentially, all of this bagasse production is designated for shipment to The Celotex Corporation in Marrero, Louisiana.

To the best of our knowledge, prior to the 1966 grinding season all baled bagasse production was handled manually from the presses to the railroad flat cars. As each bale emerged from the press it was rolled on its ends by specialized skilled laborers known as "bale rollers." Believe me, this task requires a special skill. While seemingly very simple from observation, rolling 300 lb. rectangular shaped bales, dimensions being 18 in. x 23 in. x 32 in. long, a distance of 10 to 15 feet and dropping each in a specific location on a railroad car is a very difficult job. This is at a production rate of two per minute.

Because of the severity of this type of work it has always been customary to assign two bale roller to each press. Normally, one man will be working and the other resting on an alternating basis.

In recent years a shortage of labor coupled with the apathetic attitude and the absenteeism among many on payday weekends has been a problem of grave concern at our sugar factories. Replacing a bale roller was more acute due to the specialized skill required.

After the experiences of the 1965 grinding season we at South Coast really became concerned about the possibility of having to shut down a mill especially on weekends due to the lack of bale rollers. Therefore, remembering the old adage "Necessity is the mother of invention," we sat down to put together various ideas on a system to mechanically handle bagasse bales. To minimize capital investment our objective was to develop a system to receive the bales as they came off the existing multiple presses, and to then stack the bales on the railroad cars in the customary two layers of 12 bales in each. This was the function performed by the bale rollers. When we were able to formulate a proposal which looked feasible we called Thibodaux Boiler works, who has had a lot of experience with bagasse, to help us develop and install the initial system.

In 1966 we installed at our Terrebonne Factory, where the normal grinding capacity is approximately 3000 tons per 24 hours, the first automated mechanical bagasse bale handling system. After the start-up of the initial system there were of course many minor changes and adjustments to make. However, at the termination of the 1966 crop we were well satisfied with the performance of this system. The exhibit attached hereto shows a planned view of a typical bagasse baling station mechanical handling system which we developed. Because a picture is often better than a thousand descriptive words, we will supplement this paper with a few color slides showing the major components of this system in operation.

A general description of the principal operation of this system as shown on the attached exhibit is as follows: the bales are pushed out of each individual press onto 90° curve slides until the bales reach a station referred to as a tumbler. All the tumblers are adjacent to and parallel to a belt conveyor. When the lead bale reaches a designated point on the tumbler, it actuates a limit switch which at this time, if the belt is clear, opens a gate to allow the bale to fall onto the belt. To avoid interference with another bale already on the belt from a previous tumbler, a time delay limit switch is mounted on the belt conveyor near each tumbler. When the bale already on the belt is approaching a tumbler frame it actuates a time delay switch which overrides the gate limit switch to hold the bale in the tumbler for a preset amount of time to allow the belt to clear the tumbler in question.

Note also that another very important function is performed at the tumbler besides feeding the bales on the belt. When a bale falls from the tumbler onto the belt it also turns through a 90° angle. The bales come off the presses with the 23" dimension vertically and bagasse bales are all field stacked with this dimension horizontally. The tumbler gate, because of its relative position with the belt, accomplishes both objectives in that while falling on the belt the bales also make a 90° turn. This was a somewhat difficult task to accomplish.

The long belt discharges the bagasse bales onto a declining gravity roller section conveyor which serves as a temporary surge or accumulation point. From this gravity section the bales are fed by a short feeder belt to a ram. When there are four bales in front of the ram the feeder belt stops automatically and the ram pushes the four bales, all in line, sideways onto the railroad flat car and then retracts. The ram is operated by two parallel

hydraulic cylinders. After the ram has retracted, the feeder belt starts automatically again. This operation is repeated until there are three rows of four bales on top of the railroad car after which time a scissors type grab, used for many years for field stacking of bagasse, picks up the entire layer of 12 bales and lifts them approximately 30 inches above the railroad car top. The grab is operated by a single hydraulic cylinder. The ram then makes three more pushes to complete another layer of 12 bales on the railroad car similar to the first layer, after which the grab, holding the top layer in the air, deposits it on top of the bottom layer. As each railroad car is completed with two layers, the operator moves the full car with a two drum winch or car puller, and spots an empty one in front of the ram. One man operates the ram, grab, and car movements. The ram and grab operation can be operated manually or automatically. On manual the operator merely presses a momentary push button for each individual cycle of the ram and grab. On automatic the operator merely pushes a single momentary button to initiate each 12 bale layer, after which the three strokes of the ram and one operation of the grab are all automatically performed.

With the satisfactory performance of this system at our Terrebonne Factory after the 1966 crop and with the labor situation getting progressively worse, we therefore decided to put similar installations at three other baling plants, namely Raceland, Oaklawn, and Evan Hall. The major point of consideration in planning these new installations was to design the system for a maximum of approximately 6000 tons of cane per day, which is roughly double the capacity of our Terrebonne Factory. This was accomplished by speeding up the operation of the belts, the ram, and the grab.

Now that the 1967 sugar cane grinding season is over, our most serious problem yet to be overcome is occasional bale jams on the belt. These jams

often caused 10 to 15 minute mill stops. Because of the continuity of this system and the high steady rate of bagasse bale production, there is little time for interruptions, therefore, while a bale jam or other minor interruption may require only two minutes to clear up, this necessitated a stop for the mill and all related conveyors. Restarting all this equipment usually requires a minimum of approximately 15 minutes grinding delay due to a possible two minute baling plant interruption. As our good friend, Mr. James Thibaut at Evan Hall pointed out, this bale handlimg system is 99.9 per cent perfect, but the 1/10 of 1 per cent imperfection causes grinding losses in excess of 1/10 of 1 per cent of operating time.

Therefore, one of our primary objectives now is to improve the equipment to minimize the short interruptions. However, because there may always be occasional, inherent and unavoidable short interruptions we are also considering the possibility of additional built-in surge capacity within the system which would absorb the bagasse for a short period of time and avoid stopping the mills.

We might also point out that we experienced a greater number of interruptions during the first month of the sugar cane grinding season. As the operators and other employees gained experience with the use of the equipment, there was a marked improvement in the reduction of interruptions as the grinding progressed.

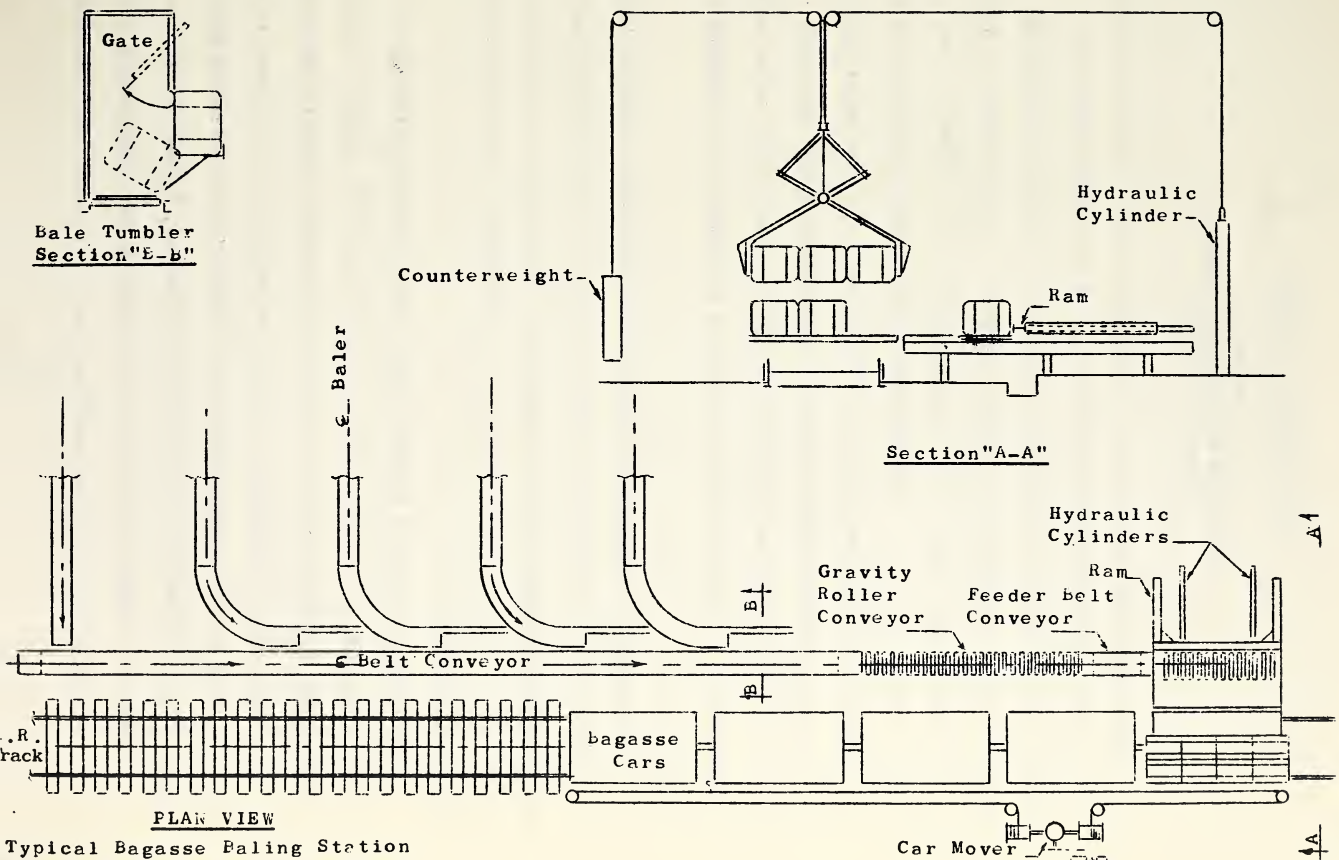
While our primary motive for installing these systems was to replace the labor which was no longer available, there is a monetary savings also. We mentioned earlier that there were two bale rollers assigned to each baler. A factory grinding at a rate of 5000 to 6000 tons per day requires at least five bagasse bale presses in operation. The new mechanical handling system eliminates both bale rollers at each press. However, the new equipment

requires one operator and at least three belt conveyor line observers to take care of broken bales, jammed bales, etc. There is a net saving of approximately five to six men per shift.

A typical installation as shown on the attached exhibit cost approximately $35,000.00. This includes a building addition to house the new equipment.

Now that the 1967 crop is behind us, we can truthfully conclude that we are happy we have these new automated mechanical bale handling facilities, for without them we would have encountered serious labor problems. We recognize that there is still a need for additional improvements but we now have definite plans on further improvements during the current idle season. Like any new innovation, continual effort, time, and experience should make this system an ideal one.

Should anyone wish to visit any of these installations, or require some additional detailed engineering data, we at South Coast would be very happy to furnish same.



Typical Bagasse Baling Station
With Mechanical Bale Handling

BULK STORAGE OF BAGASSE

D. R. Bernhardt
Valentine Pulp & Paper Company
Lockport, Louisiana

Allow me to fill in a bit of background for those of you who may not be familiar with my company. Valentine Pulp and Paper Company, located at Lockport, Louisiana, is the only such facility in this country producing bleached pulp and paper from sugar cane bagasse. Since we market our products in the United States, we are competing with paper produced in the classic manner from wood. We produce paper grades which are classified in the industry as fine papers; that is, fully bleached writing and printing papers. We use some 140,000 to 160,000 tons of mill-run (50% moisture) bagasse annually, and produce some 40,000 tons of paper. Our current bagasse requirements are supplied by four sugar mills in Lafourche and Terrebonne Parishes.

Historically the paper mill had relied on the classic system of baling and storing which is familiar to all of you. Since our depithing process was designed for essentially dry bagasse, all of our annual requirement was baled, and in fact we could not process bagasse unless it was at least three to four months old.

The need for a better and less costly method of storage had become increasingly apparent in recent years as our capacity was expanded; as costs rose (as they inevitably seem to); and as we continued to upgrade the quality of our papers to meet competition and seek new markets. At the same time we were exploring a new depithing system which would allow us to run on green bagasse directly from the sugar mills during grinding, by-passing the need for storage of at least that portion of our total annual requirements. The successful installation of this depithing system also meant that a storage

technique could be employed which did not necessarily result in drying. Further, some of the major quality disadvantages of baled bagasse were recognized as resulting from the drying process of bales through the generation of heat from fermentation. These disadvantages include increasing degradation of strength factors with time, discoloration of the fiber, and non-uniformity of the stored crop from the beginning of the usage year to the end. Furthermore, as some of you may have experienced, there usually are good stacks and not-so-good stacks of bales in a given crop year resulting from factors including weather conditions at time of harvest and the skill with which the stack was constructed.

We initiated out current studies on storage methods about two years ago. Some year before that the company had made pilot studies of bulk storage under a variety of conditions including submerged storage with relatively unimpressive results. However, we felt the potential benefits warranted a fresh look and proceeded from there. Initially we explored the wetted processes including the Ritter process as employed by a mill in South Africa, and the wet bulk pile used in recent years by a mill in Puerto Rico. Both of these systems consist of slurrying the bagasse and pumping or fluming to a pile site, allowing the excess water to drain off. We experimentally took a slightly different tack and built a pile, wetting it by means of large rotary sprinklers. However, the disadvantages of any wetted system for our use became obvious, including added transport weight of the wetted bagasse from remote storage sites such as we have; need for a suitable supply of water; cost of the wetting system, and undesirability of added water if the pith fraction is to be subsequently burned as fuel.

Thus we moved on to exploring techniques of bulk storing mill-run bagasse with no additional wetting. The problems to overcome included

excessive fermentation and heat build-up, and possibly combustion. There was some basic correlation to outside pile storage of wood chips and large storage piles of cribs of ensilage materials. Among techniques explored were various means of covering and sealing a large pile, most preferably with plastic film. However, costs were prohibitive.

We then found that if freshly milled bagasse was piled with certain precautions and in suitably large piles, a self-protective essentially anaerobic storage unit resulted which inhibited the destructive fermentation and heat build-up which occurs in bale storage. The surface layer of some few inches in depth does weather, but thus serves the part of a protective cover. It is minor in terms of total pile volume, and the surface layer quality is similar to equally aged baled bagasse. As a factor affecting total pile quality, this layer is negligible, and losses chargeable to the weathered surface appear to be less than 1%.

Once the specific design parameters were worked out it became necessary to develop staking hardware. We chose conveyer belts as the transport method from sugar mill to stack for minimum power, maintenance and tending labor requirements. Two bulk pile installations were put into operation this past grinding season. They are almost duplicate installations, utilizing doughnut shaped slabs and pivoting elevating conveyers. Pile height is 60 feet, and capacity of these units is 30,000 to 35,000 tons of mill-run bagasse.

Since it is necessary for us to transport the bulk piled material up to 30 miles, we developed special hydraulic dump trucks with capacities of 115 cubic yards.

The benefits of this storage method include:

I. Reduced Costs

a) Less capital investment is involved. We estimate, based on our own experience with both bulk and bale systems, that the bulk system as described will run about 40% of the cost of a comparably sized baling operation. This means direct unit savings in depreciation, interest and maintenance.

b) Lower operating costs, since the bulk stacking system requires but one man per shift as compared to some 18 men for baling and stacking. Power costs amount to a comparison of 25 hp for the bulk system as compared to 400 hp or more on baling. There are no supplies such as baling wire and fuel, and no stack covers to maintain and replenish.

c) Recovery yields are higher from the bulk system. We estimate 95% plus as compared to 85% or less from baled storage resulting from so-called "field losses."

d) Since considerably less is invested in the stored material with the bulk system, a savings is represented in the value of inventory carried.

II. Quality Improvements

I will footnote the quality aspects of this system by saying that these are quality factors of importance to pulp and papermaking. However, there may be common aspects to other types of bagasse products.

The various quality points which have a bearing on our results are as follows:

a) A marked reduction of degradation of the fiber which involves weight losses, discoloration and embrittlement as a direct

result of the fermentation process accompanied by heat build-up and acid hydrolysis is noted by comparison with baled storage.

b) Another direct benefit is uniformity of the stored material throughout the year. The normal degradation that takes place with bale storage tends to increase with time, yielding a relatively non-uniform raw material over the period of usage. The interior of the bulk pile tends to keep at a quality level comparable to fresh bagasse.

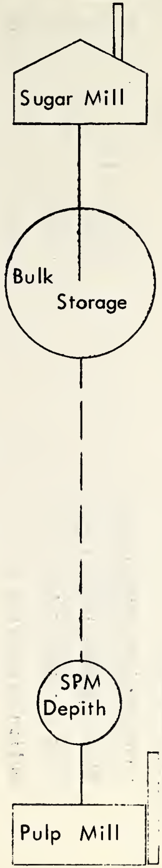
c) Chemical demand of the bulk stored fiber in pulp processing is lower than for baled stored material, yielding chemical savings and quality benefits from less severe chemical treatment. This is true both in the cooking and bleaching phases.

d) Final product quality is improved in terms of both strength and brightness.

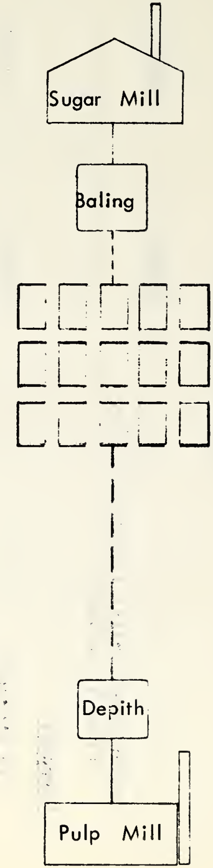
In summary, we feel that the results to date are most favorable, that we have a storage system which provides lower costs while substantially improving quality of our raw material, both of which are essential to the continued successful use of bagasse as a raw material. For those who may have further interest in this process, we would be glad to hear from you. We have applied for a process patent on the system.

Tables are attached illustrating some of the points covered in this paper.

SYSTEMS COMPARISON - FACILITIES AND EQUIPMENT



	VPPCo SYSTEM	BALE SYSTEM
STORAGE	(1) Conveyer (1) Stacking Conveyer (1) Slab	(1) Conveyer (3-4) Baling Lines Building Trucks or Train Heavy Crane Stack Covers
CONNECTED HP	25 HP	400 HP plus vehicles
STORAGE AREA	6-10 sq.ft./BD ton	45-50 sq.ft./BD ton
RECOVERY	Self-powered Loader	Heavy crane (above)
TRANSPORT (Depends on rate and distance)	8.5 BD tons/truck	12.5 BD tons/truck
DEPITHING	SPM Depither	Hammermill and Screens



BAGASSE HANDLING AND STORAGE

SYSTEMS COMPARISON

	VP&PCo.		Bales
Approximate capital investment ratio (Through recovery)	1.0	vs.	2.5
Manpower			
To storage	1/shift		18/shift
Pile Recovery	2/shift		4/shift
Transport	(Depends on rate and distance)		
Unloading	0/shift		1/shift
Total (Exclude Transport)	3/shift		23/shift
Yields - Basis sugar mill output of:	100 tons BD		100 tons BD
Storage Recovery	97 tons BD		85 tons BD
Depithed Fiber (Basis)	(15% depith)		(20% depith)
Yield	82.5 tons BD		68 tons BD
Bleached Pulp Yield, AD	44 tons AD		35.5 tons AD

TABLE I

Quality Retention and Chemical Consumption Comparison

between bulk process stored bagasse and baled stored bagasse.

	BALED-STORED AGE 12 MOS.	BULK STORED AGE 12 MOS.
Chemical Demand		
Cook chemical demand ratio	1.00	.97
Bleach demand (Cl_2) ratio	1.00	.63
Tear strength ratio	1.00	1.26
Mullen test ratio	1.00	1.05
Folding endurance ratio	1.00	1.83

FUTURE EQUIPMENT FOR THE SUGAR INDUSTRY

Walter J. Landry, General Sales Manager
J&L Engineering Company, Inc.
Jeanerette, Louisiana

First, I would like to thank the society for the privilege of being part of the program today and secondly, I want to extend our congratulations to the Louisiana growers and processors for their efforts in producing the second largest crop in the state's history. Believe me, we machinery manufacturers are loyal fans of yours. Keep up the good work.

Before we look into future trends in the sugar equipment field, let's first take a brief look at past accomplishments and facts about our industry. Thirty years ago this industry was still very dependent upon animal drawn equipment. As late as the early and mid forties much of our harvesting was done by hand. The introduction of the early Thomson and Thornton harvesters and the revolution in our industry which they created is one of such recent vintage that we all remember.

I bring up these historic facts simply to make one point at the outset here. That is, our industry, namely the manufacturing of Sugar Cane Handling Equipment for field use, is an infant one. Anyone who is of the opinion that we have reached our ultimate goals is in for some shocking surprises. The next decades, I think, will produce more revolutionary ideas than did the past thirty years combined. You may ask the question why? Well, simply because we have been conditioned for changing methods and also because there is a need for change.

Just reflect for a moment on the changes that have taken place in other industries over the past few decades. Take for example the automobile industry. Thirty years after its invention, or about the early 1930's, the automobile had undergone drastic face lifting; comfort, speed and safety features

were beginning to creep into the picture. Now look around you today and see what has happened to the automobiles since that time. The same is true of airplanes and a host of other machines including, and this is perhaps a more comparable example, the grain combine. Thirty years after its invention it was a workable but highly imperfect machine. Today the grain combine has improved to the point of near perfection.

The same story of hard work, trial and error, determination and persistence is unfolding in the cane machinery field now.

Ten, twenty, thirty years from now we will have mastered what today seems not only improbable but impossible.

Now, let's take a look at some areas where we can expect immediate accomplishments then we will try to look into the crystal ball and project possible advances for the period ahead for the next ten years.

For the immediate future I think the following changes are evident to everyone:

1. Farmers will become less dependent upon high clearance tractors.
1. Implements will become more multi-purpose.
3. Harvesters will become simpler yet more effective.
4. Loaders will take on a new look.
5. Transport equipment will carry more payload.
6. Transloading methods will eliminate chain slings.
7. Less storage at the factory will result in longer work days for field equipment.

Now let's digress for a moment and take a look at each of these points we have just mentioned.

Our first point, farmers will become less dependent on High Clearance Tractors - This is an area I think we are just beginning to explore.

Excellent chemical control of weeds has greatly reduced the need for late cultivation, and late cultivation has been the one big reason justifying the need for high clearance tractors. The 1967 harvest season witnessed many farmers hauling cane with standard clearance tractors under dry and muddy conditions.

New carts available to the industry for Cameco, Thomson and J&L operated successfully over the past several harvest seasons with approximately 24" of total clearance so it certainly isn't necessary for tractors to have more than drawbar clearance from a cane hauling standpoint.

Standard clearance tractors present several distinct advantages.

1. Lower initial cost.
2. Better performance of draft systems and three point hitch arrangement.
3. Better possibility for disposal of used equipment.

Now let's look into our second point - Implements will become more multi-purpose. We are presently accomplishing most of our land preparation and cultivation practices on a multirow basis. However, we are purchasing tractors with more and more horsepower. In fact, one manufacturer is offering a tractor with 130 drawbar horsepower. Now obviously it is not practical to do more than three row application per pass so how do we put this additional horsepower to work. We think the answer is multi-purpose operation; for example, cultivation and fertilizing operations could be combined. Application of chemicals and cultivation could be combined. Application of chemicals and/or fertilizer and seed bed preparation operations could also be combined. These are just a few possibilities which would result in doing more work in a shorter period of time and thereby reduce the required quantity of men and machines and in the final analysis reduce the cost of producing a ton of cane. For the

future also look for more power driven tools available for sugar cane farming.

Our third point, namely, harvesters will be simpler yet more effective, is a very interesting one because of all the field machinery owned by a sugar producer, none is more important than the sugar cane harvester.

"Recumbent cane is here to stay." That statement is a fact of life. Scientific farming, improved varieties and the application of this knowledge by the grower has made 60 ton cane a reality in Louisiana. If anyone is aware of these facts it is the machinery manufacturers. New innovations on harvesters in 67 and for 68 bear witness to this testimony. 68 model harvester features will emphasize performance in recumbent cane. I am not going to mention names but one machinery manufacturer with whom I have some contact has almost completely overhauled its harvester for 1968 with this objective in mind.

1967 saw the introduction of an automatic blade control device from one manufacturer. Another introduced a hydrostatic gathering control mechanism. For 1968 look for improved versions of these features and other performance type improvements. Also be on the lookout for features which will reduce maintenance and facilitate more efficient servicing. In the years ahead look for features which will accomplish both the above mentioned objectives such as simpler and more efficient drive arrangements. Weight reducing innovations will improve performance under muddy conditions. Future innovations will also deal with operator comfort and ease of control.

At this point I would like to make restoration for that little plug I sneaked in earlier by saying, and I make this statement with absolute assurance of accuracy, that all three harvester manufacturers have a great deal for which they can be proud. The entire sugar world is looking in the

direction of Louisiana for answers to its harvesting problems. For this fact we machinery manufacturers are proud to point to the Louisiana growers because you have made this possible by your acceptance and encouragement of new ideas.

Our fourth point, Loaders will take on a new look, is again one which is to some extent an accomplished fact. 1967 saw the introduction of two new self-propelled loaders both of which offer interesting features for the grower. Among some of these features are the following:

1. Increased capacity.
2. Improved handling characteristics.
3. Hydrostatic drive arrangement.
4. Faster cycle time.

For the future look for further steps in this direction.

Our fifth point - Transport equipment will carry more payload is not only a desired accomplishment but one which is necessary and of extreme importance. Transportation cost is one of the areas which afford us a great deal of room for improvement. Bulk handling is also here to stay. Our task as machinery manufacturers is no longer one of trying to promote this idea but it is one of refining and improving techniques for the coming years.

For 1968 look for (and these will be available) field carts with the following features.

1. Payload capacity approaching 10 tons.
2. Reversible manifold kits for left or right hand dump.
3. Movable axles and wheel wells enabling farmers to increase tractor wheel traction by adjusting cart balance.

These and other features will be available on carts with less than 5,000 lb. net weight each which means that these features will not compromise flotation and mud performance characteristics.

Our sixth point - Transloading methods will eliminate chain sling. At the present time two types of transloaders are available, both of which are in use in several areas of the belt. One is a self-propelled unit; the other an attachment which fits on a wheel tractor, crawler tractor or truck. These devices are replacing field derricks and draglines at a very rapid rate. Chain slings and the labor required to handle them are disappearing from the scene. Cane which because of a distance factor has to be transferred can be more economically handled this way than in the conventional manner, save perhaps the tiny grower who cannot justify the use of one of these machines and who cannot or will not joint forces with his neighbors into a group large enough for that justification. Revolutionary changes in this area will probably not occur unless the industry moves in the direction of short cut cane.

In addition to these machines several growers have themselves come up with transloading techniques which encompass the use of draglines dumping cane from chain net carts directly into trailers which are at a lower elevation.

Our seventh and final point - Less storage at the factory will result in longer work days for field equipment.

Let me say right at the beginning, I am not going to advocate night operation of harvesting and loading, although I will agree this could produce economical results under the right circumstances. I am saying, however, in essence that the more direct mill feed type of handling we do the less costly our efforts will be.

Furthermore, all other factors equal the more hours we work our equipment, the less men and machines we require and again our costs go down.

Because of these two factors we think the future will witness less

storage at the factory, more field type storage, utilization of all daylight working hours in the field and longer (14 hours or more) highway transport utilization. Combination of all these arrangements certainly make for lower cost and higher profits.

We have talked about many types of equipment here today and in order to try and further the clarity and understanding of this talk we would like to show you some of these machines on slides.

Before we do that, however, earlier we said we would look into the crystal ball and try to see what some of the possible harvesting methods of the next ten years would look like. Here again in order to make for a clearer picture, we have some slides we would like to show. These slides are concerned with different types of combine harvesters being developed which many people believe will eventually have application in Louisiana. We must point out we are talking about methods here and not precise features because these machines in order to apply in Louisiana would in all probability have a different configuration so keep that in mind.

We are not attempting here to get into the comparison of short cut cane vs. long cane and all the ramifications which are part of that picture but on the contrary to simply show you some possibilities the future offers.

COMBINES

There are two basic types of combines which we will show you today. The first is called a mat type combine; the second a gathering type combine. The mat machine concerns itself primarily with topping only the cane which is erect within a recumbent field. The gathering machine attempts to untangle the cane, sort it, stand it up and then top all of it.

All of the machines which we will show you are chopper type harvesters, i.e., they cut the cane into short pieces. The reason for this is threefold:

1. It aids in cleaning

2. Improves handling process

3. Increases density in transport units

The gathering type machine is designed and is capable of handling the lighter tonnages in the fields which have become recumbent shortly prior to harvest.

The mat machine does not attempt to gather cane at all simply because this is not feasible in heavy tonnage fields where recumbency has occurred several months, as many as 6 or more prior to harvest.

It is correct, therefore, to make the conclusion that for the foreseeable future, if and when Louisiana should move in the direction of combines, it will more than likely be the gathering type machine. The reason for this is simply because we are able to gather our down cane and remove most of the tops.

Now before we see the slides, let's take a brief look at some of the advantages and disadvantages of using combines.

On the minus side I think three things stand out.

1. Delivery of more leaf matter to the factory.

2. Reduction in sucrose because of cutting action.

3. Loss of flexibility of a two machine operation.

On the plus side of the ledger three things also stand out.

1. Delivery of fresh cane to the factory.

2. Elimination of the greatest portion of mud going into the factory.

3. Ability to transload more efficiently.

Now let's look at some of the problems which have to be solved before Louisiana can move in the direction of combines.

1. Cleaning.

   Possible solutions:

   A. Mechanical cleaning devices in the machine at the transloader, at the factory.

   B. Chemical defoliants

2. Change over the different type of transport system.

3. Change over in the millyard.

Now let's take a look at why some areas, such as Florida, are thinking in terms of combines.

1. High cutting costs (hand labor)

2. Inability of conventional machines to handle heavy tonnage in a serious state of recumbency.

Several facts are outstanding in Louisiana which present a different picture.

1. Our present harvesting machines, though not perfect, are doing an adequate job.

2. Inability to get a proper standing burn in our fields and a lack of effective cleaning devices.

3. Expensive switch to a different type of transport.

Louisiana for the reasons outlined above has no pressing economic need to change to combines. This will allow the research and development of these machines to advance to the near perfect stage before we begin to think in terms of cut-load harvesters. This time span will further allow research and development in mechanical cleaning and chemical defoliants to also progress. Our ability to select varieties to suit the harvesters is another factor in our favor which will allow us to gain additional time.

The prospect remains, however, that someday we may chose to propogate varieties which have outstanding qualities but which the conventional machine of the day cannot handle, then I think Louisiana will begin to change its thinking and perhaps combines will come to the rescue.

CONCLUSION

In concluding, I would like to say, we have tried to open wide the door which looks into the immediate future and we have tried to further open a small crack into the distant future. We have tried to do this objectively and in a spirit of open and unbiased opinion. Whether we are right in all of these matters and whether you agree with us is open to question. Nevertheless, we sincerely thank you for allowing us to be part of your program and if I may be allowed a personal remark here I wish to say I am proud to be part of this great society and this great industry.

IMPORTANT COST CONSIDERATIONS IN HANDLING CANE

Glenn R. Timmons

In 1965 the American Sugar Cane League published a comprehensive report on the cost of handling and transporting sugar cane in Louisiana. That report proved that bulk cane was cheaper to handle than slinged cane when going direct from the field to the mill. This is now always true of cane that must be transferred from a field cart to a truck-trailer. The one obstacle which we have yet to overcome in switching to 100 percent bulk cane is in developing an economical method of transfer loading bulk cane.

Any comparison of different methods of handling cane in bulk should be made in light of these three facts. The cheapest method of field loading cane is in bulk. The cheapest way to unload cane at the mill is in bulk. In most cases, bulk cane is more expensive to transfer from field carts to trailers than sling cane at this time.

I would like to report on three of the more common means of transferring cane from field carts to bulk trailers in use during the 1966 and 1967 crops. The figures I will use are based on observations made over the past two seasons. Performance rates have been established by actual measurement, and are the averages of several timings.

Conventional System

The first system will be called the conventional system. Cost figures for this system are contained in Table 1. Under this system cane is loaded in the field in slings, hauled to the transfer point and tripped into bulk trailers with a field derrick.

Under the conventional system, field loading is performed at the rate of 49 tons per hour. The equipment used is one field loader, one tractor,

Table 1. Conventional System: (49 tons per hour) Tripping Slings into Bulk Trailers.

A. Field Loading[1/]

Equipment and Labor Used	Dollars Per Hour: Labor Cost	Equipment Cost	Total Cost	Dollars Per Ton: Labor Cost	Equipment Cost	Total Cost
Field Loader		2.725	2.725		.056	.056
Operator	1.300		1.300	.027		.027
Scrapper	1.150		1.150	.023		.023
Slingmen (2)	2.300		2.300	.047		.047
Tractor		2.278	2.278		.046	.046
Driver	1.250		1.250	.026		.026
Wagons (2)		.473	.473		.010	.010
Total Cost	6.000	5.476	11.476	.123	.112	.235

B. Transfer Loading[2/]

Equipment and Labor Used	Dollars Per Hour: Labor Cost	Equipment Cost	Total Cost	Dollars Per Ton: Labor Cost	Equipment Cost	Total Cost
Derrick		1.380	1.380		.028	.028
Operator	1.250		1.250	.026		.026
Slingmen (2)	2.300		2.300	.047		.047
Tractor		2.278	2.278		.046	.046
Driver	1.250		1.250	.026		.026
Wagons (2)		.473	.473		.010	.010
Truck-Tractor		1.949	1.949		.040	.040
Driver	1.870		1.870	.038		.038
Trailer		2.072	2.072		.042	.042
Total Cost	6.670	8.152	14.822	.137	.166	.303

Total Cost from Field to Truck is 53.8 Cents Per Ton

[1/] Capacity of equipment used is about 49 tons per hour.

[2/] Actual capacity of this equipment is 65 tons per hour.

and two field carts. The labor consists of one loader operator, one scrapper, two slingmen and one tractor driver. Wages paid agricultural workers were assumed to be the required minimums in effect for the 1967 season.

Field loading costs twenty-three cents per ton when using slings (Table 1A). After the cane is loaded into field carts, it is delivered to the transfer point. The cane is loaded into bulk trailers by tripping slings. The equipment used for this operation is a field derrick, one tractor, two wagons, one truck-tractor and one bulk trailer. Labor consists of one derrick operator, one man to hook slings, one man unhook and handle slings, one truck driver, and one tractor driver.

The performance of the system in Table 1B for transferring cane is approximately 49 tons per hour. This coincides with the capacity of the field loading operation. Using the prior mentioned equipment and labor, it costs 30 cents per ton to transfer load cane by tripping slings into bulk tailers. (Table 1B). However the actual measured capacity of a field derrick is approximately 60 tons per hour.

Two Grab System

The second system of transferring cane is the two grab system. Under this method one grab is mounted on the back of a tractor, and a bigger grab is mounted on the back of a truck. The cane is loaded in bulk in the field and hauled to a transfer point. The tractor mounted grab then removes cane from the bulk wagons. The cane is stored in a pile at the transfer point. As the mill needs cane, the truck mounted grab loads bulk trailer from the storage pile. This is an advantage because it allows the mill to reduce the double handling of cane on the mill yard.

Another advantage of this system is that the grower is able to eliminate slings in the field. Therefore, slingmen are no longer needed. Based on this year's minimum wage rates, elimination of two slingmen results in a savings of $2.30 per hour. The total cost of field loading bulk cane is 21 cents per ton (Table 2A). Compare this with the 23 cents per ton using slings and you see that 2 cents per ton can be saved by field loading bulk cane. This is a good illustration of why all cane hauled direct to the mill from the field should be handled in bulk.

Under the two grab system, the bulk cane is hauled to the transfer point, and taken from the wagon by a tractor mounted grab to be placed on the ground. The equipment involved in unloading the field carts is a tractor mounted grab, a field tractor, bulk carts, and a scrapping tractor. The labor involved is the grab operator and the tractor driver. The scrapping tractor is also operated by the grab operator. Assuming a performance rate of 45 tons per hour and using the cost figures in Table 2B, it is determined that it cost 22 cents per ton to unload bulk cane into a storage pile. Generally, under this system the grower's responsibility ends when the cane is put on the ground at the transfer point. The mill then assumes the responsibility for loading and hauling the cane to the mill. We cannot fairly end the comparison between the two grab system and other systems at the point where grower's responsibility ends. In order for any new system of transferring cane to be acceptable, it must perform the total transfer job cheaper and as satisfactorily as the existing system. Therefore, we need to further analyze the two grab system to determine the cost of getting the cane from the storage pile to the trailer. The equipment used in this operation is a truck mounted grab, a truck-tractor, and a bulk trailer. Labor consists of a grab operator and a truck driver. Cane is loaded from the storage pile into the trailer at the rate of 60 tons

Table 2. Two Grab System: (45 tons per hour) One Grab Takes Cane From Carts to Storage Pile and One Grab Takes Cane From Pile to Trucks.

A. Field Loading 1/

Equipment and Labor Used	Dollars Per Hour Labor Cost	Dollars Per Hour Equipment Cost	Dollars Per Hour Total Cost	Dollars Per Ton Labor Cost	Dollars Per Ton Equipment Cost	Dollars Per Ton Total Cost
Field Loader		2.725	2.725		.061	.061
Operator	1.300		1.300	.029		.029
Scrapper	1.150		1.150	.026		.026
Tractor		2.278	2.278		.051	.051
Driver	1.250		1.250	.028		.028
Wagons (2)		.608	.608		.014	.014
Total Cost	3.700	5.611	9.311	.083	.126	.209

B. Transferring (From Cart to Storage Pile) 2/

Equipment and Labor Used	Dollars Per Hour Labor Cost	Dollars Per Hour Equipment Cost	Dollars Per Hour Total Cost	Dollars Per Ton Labor Cost	Dollars Per Ton Equipment Cost	Dollars Per Ton Total Cost
Grab (tractor mounted)		2.846	2.846		.063	.063
Operator	1.250		1.250	.028		.028
Tractor (scrapping)		1.684	1.684		.037	.037
Tractor		2.278	2.278		.051	.051
Driver	1.250		1.250	.028		.028
Wagons (2)		.608	.608		.014	.014
Total Cost	2.500	7.416	9.916	.056	.165	.221

C. Transferring (From Storage Pile to Truck, 60 Tons Per Hour) 3/

Equipment and Labor Used	Dollars Per Hour Labor Cost	Dollars Per Hour Equipment Cost	Dollars Per Hour Total Cost	Dollars Per Ton Labor Cost	Dollars Per Ton Equipment Cost	Dollars Per Ton Total Cost
Grab (truck mounted)		3.110	3.110		.052	.052
Operator	1.250		1.250	.021		.021
Truck-tractor		1.949	1.949		.032	.032
Driver	1.870		1.870	.031		.031
Trailer		2.072	2.072		.035	.035
Total Cost	3.120	7.131	10.251	.052	.119	.171

Total Cost from Field to Truck is 60.1 Cents Per Ton.

1/Actual capacity of this equipment is about 52 tons per hour.

2/Capacity of this equipment is 45 tons per hour.

3/Assumed that this equipment will work on more than one farm.

per hour. Using the cost data and performance rates shown in Table 2C, it is determined that it costs 17 cents per ton to load bulk cane from the storage pile to bulk trailers.

The total cost of field loading bulk cane and transferring to trailers using a two grab system is 60 cents per ton (Table 2A plus 2B plus 2C). The cost of the conventional system is 54 cents per ton for doing the same thing. (Table 1A plus 1B).

<u>One Grab System</u>

The next system is the one grab system. Under this method, one grab is used to both unload bulk cane from field carts as well as load cane into bulk trailers.

Cane is field loaded in bulk carts. Equipment and labor requirements are the same as with the two grab system, however rates of performance are different. The cane is hauled to the transfer point where it is either unloaded onto a pile or into a trailer. In most cases, whether cane is placed on the ground or not some provision has to be made for scrapping around the pile. Where truck mounted grabs were used, a special tractor had to be kept at the transfer point for scrapping. This is the case presented in Table 3A and 3B.

The equipment used for transfer loading is a hydraulic grab, a field tractor, two bulk carts, a truck-tractor, a bulk trailer and a scrapping tractor. The labor consists of grab operator, tractor driver, and truck driver. The grab operator also drives the scrapping tractor. Growers have not been successful in achieving high rates of performance over long periods of time with this system. Fifty tons per hour appear to be a reasonable rate of performance for this system at this time. Using that rate of performance with the cost figures in Table 3B, the cost of transferring cane using the one grab system is 34 cents per ton. The total cost of loading bulk cane in the

Table 3. One Grab System: (50 tons per hour) Same Grab Loads Truck that Unloads Field Carts.

A. Field Loading[1/]

Equipment and Labor Used	Dollars Per Hour: Labor Cost	Equipment Cost	Total Cost	Dollars Per Ton: Labor Cost	Equipment Cost	Total Cost
Field Loader		2.725	2.725		.054	.054
Operator	1.300		1.300	.026		.026
Scrapper	1.150		1.150	.023		.023
Tractor		2.278	2.278		.046	.046
Driver	1.250		1.250	.025		.025
Wagons (2)		.608	.608		.012	.012
Total Cost	3.700	5.611	9.311	.074	.112	.186

B. Transferring (Taking Cane from Field Wagons to Truck)[2/]

Equipment and Labor Used	Dollars Per Hour: Labor Cost	Equipment Cost	Total Cost	Dollars Per Ton: Labor Cost	Equipment Cost	Total Cost
Grab		4.268	4.268		.085	.085
Operator	1.250		1.250	.025		.025
Tractor (Scrapping)		1.684	1.684		.034	.034
Tractor		2.278	2.278		.046	.046
Driver	1.250		1.250	.025		.025
Wagons		.608	.608		.012	.012
Truck-tractor		1.949	1.949		.039	.039
Driver	1.870		1.870	.037		.037
Trailer		2.072	2.072		.041	.041
Total Cost	4.370	12.859	17.229	.087	.257	.344

Total Cost from Field to Truck is 53.0 Cents Per Ton

1/Actual Capacity of this equipment is about 52 tons per hour.

2/Capacity of this equipment is about 50 tons per hour.

field and transferring it to bulk trailers is 53 cents per ton (Table 3A plus 3B).

Labor and Equipment Cost Relationship

The more mechanized systems of transfer loading cane studied had one major fault. They all saved labor and thereby reduced the per ton labor cost. However, any savings in labor has been more than offset by increases in the equipment cost. This can be seen in Table 4.

Table 4. Summary of Costs of Field Loading and Transfer Loading under Three Systems, with All Systems Operating at 45 Tons Per Hour.

Type of System	Dollars Per Ton Labor	Equipment	Total
Conventional	.28	.30	.58
Two Grab	.19	.41	.60
One Grab	.18	.41	.59

For example, with all three systems operating at 45 tons per hour, the one grab system realizes a 10 cent per ton savings over the conventional system in labor cost. At the same time equipment costs of the one grab system are 11 cents per ton greater than the conventional system. Therefore, the total cost of operating the one grab system is about 1 cent per ton greater than the conventional system.

By looking at Table 4 and the above example, we can see that labor savings is not the only consideration in accepting a new system. Both labor and equipment cost should be considered to determine the most economical method of transfer loading cane.

This is not to say that existing grab type systems should be abandoned

in favor of tripping slings. On the contrary, further development of any new system that shows promise should be encouraged. However, widespread use of any new system should not be advocated until it is concluded that the new system is the best possible one at the time.

Special attention is called to the fact that the per-ton cost data I have presented and the conclusions I have reached are based on the performance rates shown for the various pieces of equipment. If actual performance rates on a farm are lower than those shown, then per-ton costs will be higher than those I have shown. Actually, the performance rates on most farms will be lower, because growers' delivery quotas will not be large enough to permit the equipment to accomplish the performance rates I have shown. On such farms, the per ton costs should be calculated on the basis of the delivery quota, which would be the actual performance rate. In these cases, it will be found that the per-ton costs of the conventional system and the one grab system are about the same.

Other Transfer Loading Systems

The three systems already discussed are not the only ones existing in Louisiana today. Several growers are experimenting with systems of dumping bulk cane direct into trailers. This is being done either with a ramp for the tractor and wagons or a pit for the trailer. One grower is using a mobile retaining wall connected to the dragline. The field carts drive between the dragline and the retaining wall. The dragline then dumps the bulk cane over the retaining wall into a storage pile. The cane is later put into trailers by a truck mounted grab.

There are some out of state commercial firms interested in this problem. One such company feels that containerization is the answer. In other words rather than transferring the cane itself, they propose to transfer the

container that holds the cane. They feel that they can design a wagon chassis that will carry a removable chain-net container. This container will hold 6 to 8 tons of cane. The containers will be loaded in the field the same as we now load bulk cane. The cane will then be hauled to a transfer point. At this time, the tractor driver will release a catch and the weight of the container will cause the wagon frame to slowly tilt, similar to a dump truck. When the rear end of the container touches the ground, the tractor driver will pull forward slowly. This will allow the container to slide off of the chassis onto the ground. The containers will stand on runners similar to those on a sled. The tractor driver will then back up to an empty container. A cable, from a hydraulic winch, on the wagon chassis would be hooked to the empty container and the empty container pulled onto the frame. The tractor would go back to the field to refill the container.

After three full containers are at the transfer point, a truck with a flat bed trailer would arrive. The truck would have a hydraulic winch near the cab. The flat bed trailer would have channels near the edges of the trailer bed. The runners on the containers would fit into these channels. The flat bed trailer need not have a solid floor. The truck driver would back up to a full container and drop his tailgate. He then would connect the cable from the winch to the full container and pull it onto the trailer. The runners on the container would slide in the channels on the trailer bed, which would guide the container on the trailer. Once on the trailer, the containers would be locked down, either hydraulically or mechanically.

It would take three containers to fill each trailer, giving a load of 18 to 24 tons of cane. If such a system is feasible, there would be no labor other than the truck driver and the tractor driver and no special equipment at the transfer point.

Most of the methods mentioned are designed to completely replace the field derrick. But, what can a grower do until a new system is perfected both economically and mechanically? One possibility would be the modification of conventional field carts so that the slings do not have to be tied until the cane reaches the field derrick. This would involve the raising of the sides of the wagons. The slings would be arranged, ready for loading, in the wagons at the derrick site by the derrick crew. Several sets of slings could be placed in the wagon with the sling ends hooked on pegs of some sort. The wagons would then be taken into the field and loaded. After being loaded the wagons would be brought to the field derrick site. Once at the derrick, the slings would then be tied. The same man who normally hooks bundles at the derrick, or the tractor driver, could tie the slings. Such a system would have two advantages. It would eliminate two men in the field and allow the grower the use of the cheapest transfer method to date, namely the tripping of slings. Some growers who ship to Myrtle Grove Factory already use this system.

The fact that some growers have adopted this practice illustrates a very important point. That is, before completely eliminating any existing system we should be certain that we have considered all possible practical modifications of that system. Only when we have assured ourselves that a completely new system is cheaper than any form of the existing system should the new system be adopted.

Converting Direct Deliveries to Bulk

There is a very definite area of savings in cane handling that should be explored before next year. During 1967 approximately 1,200,000 tons of cane were delivered in slings direct to the mills in conventional field carts. In most cases, this cane could have been handled cheaper in bulk and with greater convenience. The growers of this cane would realize a 5 cent a ton

savings for every set of slingmen eliminated. The mills would realize a savings that should approximate the growers savings. Therefore, every attempt should be made next year to convert to bulk the deliveries which are direct from field to mill.

Waiting Time

There is another area of potential savings in cane handling that may prove to be the greatest savings the Louisiana sugar industry can make. That would be the reduction in waiting time for vehicles to unload at the mill. This is certainly not a new idea. The American Sugar Cane League has been promising elimination of waiting lines for years. There is one basis cause for long waiting lines - too many hauling units. In order to reduce the number of hauling vehicles, someone must take control and promote the idea of using fewer hauling units.

Switching from slings to bulk cane will not by itself result in reduced waiting times at the mill. At first, as a mill begins to accept part of its cane in bulk, shippers may notice a reduction in waiting time. This may be true for shippers of both bulk and slinged cane. However, some growers will eventually see an opportunity to deliver their quota in bulk earlier in the day by putting on more hauling vehicles. This idea is contagious, and soon other growers will add extra hauling units. As the number of hauling units increases, the waiting time will also increase. The amount of cane hauled per unit will decrease, and the per ton hauling cost will increase. The attempt to deliver cane to the mill by using more vehicles is self defeating. Each time a new truck is added, all other trucks will haul less cane. As this happens, both the cost of delivering cane, and waiting time increase.

Studies conducted using 1967 wages and equipment costs indicate that it cost 7 cents per minute for a truck with 24 tons to wait in line. It is

not uncommon to have such a truck wait between 45 minutes and one hour to unload. This means it is costing $3.15 to $4.20 per hour for the truck to stay in line. The cost is essentially 7 cents per minute for a tractor and two wagons hauling 6.5 tons. It costs $1.05 for the tractors and wagons to wait 15 minutes.

Some mills have already reduced waiting time. Some mills assign each grower a number of hauling units based on his daily quota and hauling distance. These mills report that they have reduced the number of hauling units by as much as 33 per cent. This is a direct saving to the shippers.

For example, Mr. W. S. Chadwick, President of Southdown, Inc., reports that Greenwood Factory, reduced the number of trucks used in 1967 by one-third of the number used in 1966. As a result waiting time at the mill was reduced significantly. The reduction in the number of trucks had no effect on the amount of cane delivered to the mill.

No one can possibly design a universal plan for controlling deliveries that can be applied to all mills. Each mill has circumstances particular to its own operations and locality. For this reason, a delivery system that works at one mill can only serve as a general guide for initiating a delivery system at another mill.

Double Handling of Cane

There is one other area in which we could realize a substantial savings. That would be through the elimination of the double handling of cane stored for night grinding. The potential savings is hard to determine, because we do not know the extent of losses through deterioration in the storage stack. However, based on 1965 figures, we would save at least 20 cents per ton through elimination of the double handling of cane. This figure will be higher today and in the future due to increasing labor costs.

The 20 cents does not include any losses due to quality deterioration. Night delivery is one solution to the problem of double handling of cane which has not been accepted in Louisiana to date, but I feel confident that it is only a matter of time before it is tried in Louisiana. Twenty-four hour delivery of cane has been the practice in Hawaii for many years and by two Florida mills for several years.

Night deliveries would consist of field loading, hauling, and dumping direct onto the feeder table of fresh cane. There is some doubt that night deliveries would completely eliminate the need for any storage. However, there is no question that night deliveries would allow the mills to store a much smaller amount of cane than they now store. This in turn would greatly reduce losses due to deterioration and the cost of double handling.

Night deliveries offer no savings for small growers. There may be some small savings in field operations for the larger growers, but the main savings will come in reduced double handling of cane. For that reason mills with 50 percent or more administration cane would realize the greatest benefits from night deliveries.

Those processors considering large investments in bridge cranes or new derricks should consider night delivery of cane as a possible alternative.

Summary

I would like to close by emphasizing the main points of my paper.

At this time, there appears to be no cheaper method of transfer loading bulk cane than tripping slings. Experimentation with new methods and modifications of existing methods of transferring cane is desirable and should be encouraged. Any new method which is to be widely adopted, should first be proven unquestionably more economical than any form of tripping slings. The

number of men required to operate a system should not be the only measure for acceptance of the system. Equipment cost must also be considered.

Several systems were not studied this year because of the time element and the desire to work just with the more common methods. Next year I would like to be able to report on the methods not covered this year. A large number of growers will handle their cane in slings again next year. They should explore the possibility of tying the slings at the derrick site rather than in the field. My studies indicate that the derrick crew will have the time to do this.

Serious consideration should be given to moving in bulk all cane that will be delivered direct to the mills from the field next year. Both growers and mills will benefit.

We are still hauling cane to the mill with too many vehicles. Several mills have limited the number of hauling units each shipper could use. In some cases shippers hauled more cane in 1967 than in 1966 with thirty percent fewer hauling units. Both mills and shippers have been pleased once a controlled delivery system was put into effect.

Double handling of cane at the mill, or in the field, is a costly practice to the Louisiana sugar industry. One eventual solution to this problem is night deliveries. However, this will work best at mills having 50 percent or more administration cane.

So often we hear certain people predicting the death of the Louisiana sugar industry. They have been doing this since sugar first grew in Louisiana and they will probably still be doing so from the moon. As long as the Louisiana sugar industry is comprised of people not afraid to work and accept new ideas, we have no problem.

PRINCIPLES AND TECHNIQUES IN THE APPLICATION OF SUGARCANE HERBICIDES

William P. Fussell
Bel Chemical & Supply Co., Inc.
Schriever, La.

The chemical industry spends many millions of dollars annually in developing new chemicals for control of weeds and grass. It has some of the highest paid research personnel in the country spending all of their time in the laboratories to determine if new compound have herbicidal qualities. Research and development teams then take these materials out into the fields to see if they have any practical uses. A material may be excellent in the laboratory under controlled conditions, but it must be practical in regard to cost, application, residue, weather, and be able to tell the difference between a weed and a desirable plant.

After all the development work is done the best herbicide "isn't worth a dime" until it is taken from the container, mixed in a tank, and applied as directed on the ground or crop. The extent that proper techniques and methods of application are used will control the degree of success of any herbicide.

There are two general approaches to chemical control of weeds and grasses. These are pre-emergence application - before emergence of weeds and grasses, and post-emergence application - after emergence of weeds and grasses. Some herbicides have combined pre-emergence and post-emergence qualities. That is, they are toxic to some weeds and grasses that have already emerged, and have a pre-emergence effect on seeds that have not yet germinated.

Only in the last fifteen to twenty years - with the development of new and complex chemicals - has pre-emergence application come into it's own. Usually the pre-emergence chemical is applied over the soil surface,

generally after planting. It can be a broadcast or band treatment and, in general, the sooner the application is made after planting the better the control. If there is a delay the application may be prevented by weather or other factors.

What affects the longevity of the pre-emergence applied chemicals? Why do they last or fail to last, as the case may be? A number of factors are involved.

Leaching, or the downward movement of the materials through the soil by rainfall is one such factor. The chemical is applied to the soil surface and is moved into the germination zone by rainfall or it may be incorporated into the soil in the germinating zone, thus killing the weed and grass seeds as they germinate. The length of time that the chemical remains in the soil is determined by its ability to resist leaching. After the chemical has leached on through the soil the seeds that remain are free to germinate and grow. Some chemicals have a toxic effect on the roots of the seedlings. This extends the residual control. The chemical's solubility in water, the amount of water passing through the soil, and the relative absorptive qualities of chemical and soil determine how quickly the material is leached through the soil.

Another factor that affects the persistence of the chemical is photo-decomposition or decomposition by sunlight. This occurs when the chemical remains on the surface of the soil for extended period of time when there is an abundance of sunlight.

Decomposition by microorganisms affects the life of material that is applied as a pre-emergence chemical. Bacteria and fungi and other soil organisms act in some way on practically everything that is applied to the soil. Some chemicals are more easily decomposed than others depending on variations in composition. .

Herbicides may also be chemically decomposed. This action destroys some and activates others. Chemical decomposition involved such processes as oxidation, hydration, etc.

Adsorption on soil colloids also determines the effectiveness and longevity of chemicals. Clay soils are the chief culprits and higher rates of application are generally required on soils of high clay content than on sands or sandy loams.

Volatility may play a part in the longevity of pre-emergence chemicals. All chemicals - whether liquids or solids - have a vapor pressure and may evaporate and be lost to the air as volatile gases. Volatility is reduced as the chemical is carried into the soil by rainfall.

We can sometimes modify or alleviate these drawbacks by mixing two or more chemicals together. Such mixtures may attack the problem in two different ways or the chemicals may compliment each other in such a way as to overcome a weakness of one of them.

When the rates and methods of application are set up by the research and development teams of the manufacturer, working with the various state and federal research people, all of the above items are considered.

A post-emergence application is made after the seeds germinate and begin to grow. The smaller the grasses and weeds the easier they are to kill. In this type of application the materials may be either contact sprays or they may be translocated in the plant.

An example of a contact spray is the use of herbicidal oil or salt or low rates of chlorate.

Translocated chemicals are typified by dalapon and the hormones such as 2,4-D amine or silvex.

Several items determine the degree of control obtained in post-emergence application.

The most important is coverage. The best of herbicides when applied with poor coverage can only give poor control. This has been demonstrated many times when applying some of our Johnson grass control chemicals with a little too much wind. The spray pattern is distorted, giving poor coverage and little or no results.

Translocated chemicals are taken in through the leaf area and moved through the plant. This is often important when weeds and grasses reproduce through stolons or rhizomes as the herbicide must be moved through the plants into the roots. Johnson grass and Bermuda grass are examples of this type.

Materials translocate best when the plant is growing fast. Warm moist conditions are usually the best for translocation of herbicides. Conversely, in cold weather or when there is a long dry period and plants are under drouth stress, there is little translocation in the plant.

Dalapon has given poor control of grasses many times under these conditions and the chemical has been blamed instead of the weather.

In post-emergence applications we are faced with a wide range of conditions but can resort to some helpful practices. The addition of a surfacant or wetting agent to the spray solution has become commonplace in recent years. These wetting agents aid in breaking down surface tension and in penetration of waxy cuticles. They allow more material to be taken into the plant in a shorter period of time. This is especially important when we work with materials that may be affected by sunlight or, during periods of shower activity, when the chemicals need to work in a hurry. Care must be taken that the quantity of surfactant is not sufficient to remove the selectivity of the herbicide.

Our discussion now turns to the application of herbicides, thinking in terms of methods, techniques, and equipment.

Herbicides come in a variety of forms. These are soluble liquids such as 2,4-D amine, soluble solids such as TCA and dalapon, wettable powders that are suspended such as Sinbar or Atrazine, and emulsifiable liquids of the oil and water type such as 2,4-D ester and silvex. The sprayer should be capable of handling all these types of materials.

A sprayer consists of a tank, a pump, a pressure control system, and a spray boom with all the necessary piping. In general the sprayer will be used in conjunction with a tractor and we will discuss it by parts.

The tank may be a drum mounted on the tractor or it can be of 500 gallons or more capacity pulled behind the tractor on a trailer. To be of maximum utility it should carry sufficient water to eliminate frequent refilling and yet not be so heavy that it is difficult to get through the field if it is damp.

In construction it is less trouble if the tank is resistant to corrosion. Fiber glass tanks are popular but somewhat fragile. Stainless steel tanks are expensive and, unless of substantial thickness, tend to be brittle. Steel tanks that are lined with epoxy or some other plastic are good so long as the lining remains intact. In general the amount of care given to the tank will determine it's length of life.

A tank with mechanical agitation saves time since materials need not be pre-mixed. Wettable powders are kept in good suspension. Otherwise a system of hydraulic agitation can be installed in the tank that will give good mixing of both soluble and emulsifiable liquids and that will suspend wettable powders. Soluble solids, such as TCA and dalapon will have to be pre-mixed if hydraulic agitation is used. A schematic drawing for proper

installation of hydraulic agitation can be obtained from your chemical supplier and he should be able to aid you in planning it's use.

All tanks should have a filler opening of ample size - 12 to 16 inches in diameter - with a leakproof cover. This always saves time and chemicals.

A variety of pumps are available for use on sprayers.

The best is a good quality piston pump of 10 gallon per minute, or more, capacity. It handles all solutions and suspensions without excessive down-time or maintenance but it is an expensive item.

Diaphragm pumps are in the same order of dependability but most of those used for spraying have a low capacity.

Roller pumps, a type of gear pump, are inexpensive, are available with ample capacity and are highly popular. With care they can be used with wettable powders. Corrosive liquids may cause bearing and seal trouble if they are not kept clean.

Spur gear pumps, unless the gears are of hardened metal, wear fast when used with wettable powders. Many of them are unsatisfactory in other wearing properties. Some types, however, have given service comparable to good roller pumps.

Centrifugal pumps are high volume, low pressure, pumps. They handle all types of chemicals and are moderate in cost. Their weaknesses are seals and the gear train or other device required for the high speed that they must turn.

Pumps and mechanical agitators may be engine driven, PTO driven, or driven by a hydraulic motor. Pumps used on tanks with hydraulic agitation must have sufficient capacity to supply the sprayer, the hydraulic agitator, and by-pass enough liquid to allow for controlling the pressure.

The pressure control system of a sprayer is relatively simple and your

chemical supplier should be able to provide you with information as to the items required for satisfactory operation and their installation.

The spray boom, in sugarcane, is normally made to cover three rows. It should be rugged enough to carry the nozzles and drops used; be hinged to travel on roads; and have an adjustable mount so that it can be raised or lowered easily according to the spray work being done.

The boom control should be mounted near the operator and should include a separate turn-off valve for each row and a master valve for all three rows.

The chemical supplier can furnish a spray nozzle catalog and, with a little study, it becomes obvious that there is a spray tip for every purpose. Flat spray tips are the usual choice for herbicides and the hardened stainless steel tips are the best. Orifies on brass tips wear rapidly and give a distorted pattern, especially when wettable powders are put through them.

The nozzles should be on an adjustable mount so that the pattern can be altered as desired.

With the sprayer on hand, it is time to plan a program.

Recommendations on choices of chemical practices are available at your county agent's office. From these you can decide which chemicals to use and the rates of application.

When you get the chemicals, and before you use them, READ THE LABELS.

Now pick an operator and a tractor.

The operator should be of the caliber that he can comprehend what he is attempting to do and recognize the deficiencies as they occur. He should be familiar with the functions of the sprayer and be able to adjust for varied operations and make field repairs as needed.

The tractor should be of good quality. Using the worse tractor on the place to pull the sprayer is not good management. It should steer well and

operate at a constant speed. Remember that speed is one of the factors that determine rate per acre.

Calibration of the spray equipment is of the utmost importance. Knowing how much solution per acre and thus how many acres per tank can save headaches later. Over-dosage can damage the crop and too little chemical can let weeds and grass re-infest acres that have had costly preparation. The gallons per acre sprayed is determined by the speed of the sprayer, the pressure and the output of the nozzles. Vary any one of these and the rate per acre varies. The throttle setting should be such that it can be maintained with minimum effort. Full throttle is recommended here because it is more likely to remain constant, once it is set.

The tractor should be calibrated on areas the same as, or similar to, the areas to be sprayed. There will be a difference in the speed if checked on loose soil when compared to a hard surface. There is some reduction in speed caused by loose soil or clods in the middles.

The most common method of calibration is to fill the sprayer with water and spray a known acreage and determine the gallons used and thus determine the acres per tank. The chemicals are then mixed accordingly, multiplying the acres per tank by the pounds per acre recommended.

There are many other ways to calibrate spray machine. Information on this subject can be obtained from most suppliers upon request. Many suppliers of materials will assist the grower in getting his operation going, because they recognize the importance of proper application and its relationship to the proper performance of the chemical.

The unit should be checked periodically to determine if the acres treated are consistent with the calibrated acreage. Malfunction of belts and pressure regulators, gauges, pumps, and tractors can cause trouble.

Minor variations can occur for any number of reasons and should be ignored if they are only minor.

When mixing material in the spray tank, the tank should be filled 1/2 to 2/3 full of water. The chemical should then be added and thoroughly mixed or dissolved before the balance of the water is added. Hormones should be added to the tank last when they are being used in conjunction with some of the other materials such as TCA and dalapon. If the tank does not have mechanical agitation, solid materials must be premixed and then added to the spray tank. Jet agitation or hydraulic agitation does not usually lend itself to a mixing operation.

The nozzles are adjusted to give the proper pattern on top of the row or over the top of the crops. This is to insure the good coverage necessary to give good control.

A band width of 24 to 36 inches is recommended with emphasis in recent years being on the 36 inch figures. This wider band prevents the encroaching grasses from lapping in the middle of row over the top of, but not rooted in, the treated zone. Wider band widths are also good in that if rows are somewhat crooked the drill will still be within the treated band.

The nozzles should be approximately 15 inches apart with the two outer nozzles on each row being six to eight inches lower than the center nozzle. The two outer nozzles are turned inward giving good coverage on top of the row and marking the pattern well down on the sides of the row.

Boom widths are usually spaced so that three rows can be sprayed at one time. Longer boom widths are not really practical as long as the sprayer runs astride one row. Minor variations in depth of middles are multiplied out at the end of the booms and therefore they are too low on one side and too high on the other side. A machine that sits astride two rows can use

longer booms with success. Uniformity of row width is extremely important in this instance. Wider booms can and are used quite frequently for broadcast application where height is not as critical as with banded applications.

Lay-by applications of herbicides in the cane belt are gaining in popularity. For many years the crop was laid by with cultivation and no thought given to using chemicals to prevent growth of seedling grasses and weeds. If the season was just right, then the cane would shade the row and prevent the grasses from growing. Since more emphasis has been put on chemical weed control in general, lay-by chemical control has increased. It is done to maintain the control established by earlier application and prevent seed production to infest successive stubble crops. Earlier lay-by can be accomplished by using herbicides which saves the cost of one or more cultivations. Lay-by applications should be broadcast to prevent the germination of weeds and grasses in the middles. Many growers have turned to the lay-by spray to prevent tie-vine growth, especially in areas where airplane application may be difficult.

There is no known case where weeds and grasses have become resistant to a herbicide.

Then why do we have a continuing weed or grass problem?

Some weeds and grasses were never controlled and as other susceptible species were eliminated the resistant ones were allowed to grow and flourish. Soon they become a problem and another chemical has to be used to control them. This then becomes the standard practice.

Weed control will be a never ending practice. Weeds will always be with us. Seeds are constantly being moved about the country side by birds, insects, livestock, and other means. Our soils are a vast storehouse of ungerminated seeds and, with the deeper cultivation practices that are

being used, we continually bring to the surface these seeds to be acted on by sunlight and heat.

Newer and better methods of weed control are constantly being developed. Longer lasting materials with great selectivity and wide safety factors are being brought forth by the companies and their research people. It can be said without fear of contradiction that there will always be weeds and grasses for the chemicals to control and we will have the chemicals to control the weeds and grasses judging by the past actions of the chemical manufacturers, and the stubborness of mother nature.

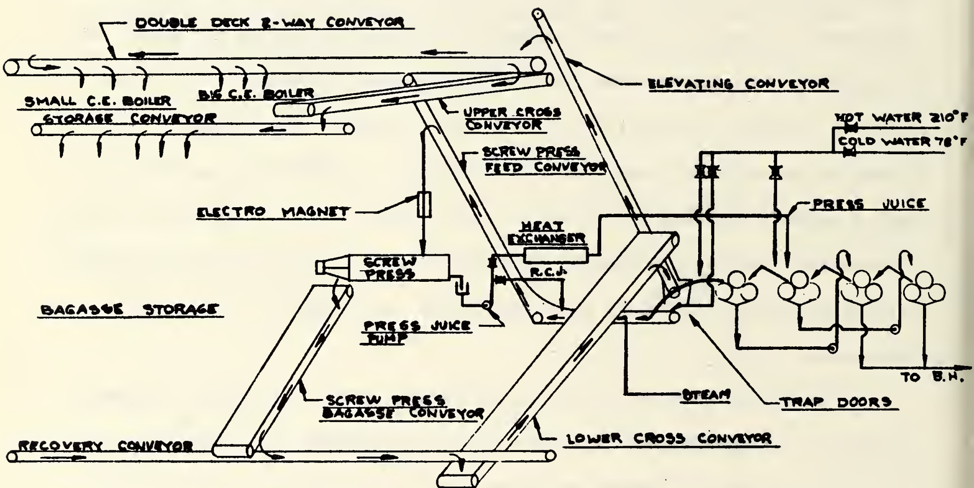
OPERATING HISTORY OF THE FRENCH BAGASSE SCREW PRESS IN FLORIDA

John Dillon
The French Oil Mill Machinery Company

The first French screw press installation of commercial size in the Florida sugar industry was located at the Clewiston mill of U. S. Sugar Corporation and was made during the latter part of the 1965-66 season. This installation of a Model J-88 press was for the purpose of improving sucrose extraction following a 23-roll tandem. The grinding rate in the plant was about 8000 tons cane per day with the French press handling 35-40%. The bagasse left the final mill at 3.5-4.0% pol and about 54% moisture. Only 2 weeks of grinding time remained after the press installation was completed, and a number of things were tried in such a short time that the data were not considered conclusive; however, indications were that the press was capable of reducing sucrose content of final bagasse by up to 50% when using normal maceration rates.

In Figure 1 may be seen a typical screw press installation following a system of 3-roller mills. This particular arrangement is in operation at Grove Farm Company in Hawaii which was the final destination of the French press referred to in the first paragraph, a 3-way proposition being worked out between U. S. Sugar, Grove Farm, and French wherein Grove Farm became the recipient of the Model J-88 with U. S. Sugar taking delivery on a much larger Model K-70 press during the 1966-67 season.

During the 1966-67 Florida grinding season two French Model K-70 screw presses were placed in operation at the new Quaker Oats furfural plant in Belle Glade. These machines, arranged in parallel, were designed to accept between them the total bagasse from the Belle Glade Co-OP, about 25 tons



GROVE FARM Co. FRENCH SCREW PRESS ARRANGEMENT

FIGURE 1

dry fiber each per hour. It was to be their function to further dewater the bagasse after presteaming and to form it into a dense plug at the discharge end of the press capable of withstanding the 150 p.s.i. pressure in the reaction vessels. Due to the pressurized atmosphere into which the dewatered bagasse was added no moisture tests could be made.

Both presses ran throughout the season with no mechanical difficulties, except for a failure in one machine of the connecting rod to which the hydraulically-loaded drainage cone connects at one end. It was felt that corrosion from contact with acidic vapor led to this failure. The area of severe corrosion was redesigned before the 1967-68 season when no such failures occurred.

During the 1966-67 season as well as the season just past the presses handled 12-25 tons dry fiber per hour each, using about 900 H.P. at the 25 ton rate. The presses are powered by 1250 H.P. motors on the main screws plus 100 H.P. on the feedworm motors.

The operation of the K-70 press installation at U. S. Sugar Corporation at Clewiston, Florida, provided far more data and information than did the experience at Quaker Oats Company. The U. S. Sugar press was placed in operation on January 22, 1967. After the first 8 days of operation, a pinion in the integral gear-box drive split open through its kewway, and the machine was out of service. The failed pinion was examined by its manufacturer and judged to have been defective. Unfortunately, there were no spares available and the time required for a permanent replacement would have precluded further operation of the press for the remainder of the season. Therefore, a fabrication was quickly produced from a substitute material which would permit the press to operate at not more than 475 H.P. The press was again placed in operation on February 27.

During the first seven days operation before the pinion failed, the following data were recorded. The figures shown are the average results of 28 sets of samples taken; and resulted from operation with an experimental slotted drainage cone:

	FINAL MILL	FRENCH PRESS
TONS CANE/HR. RATE	353	224
TONS FIBER/HR. RATE	37.0	23.4
BAGASSE POL	3.67%	2.34%
BAGASSE MOISTURE	55.24%	51.64%
EXP. JUICE PURITY	77.12	74.39
AVERAGE MACERATION USED % TO WT. OF CANE (PRESS ONLY)		12.7%
AVERAGE REDUCTION IN BAGASSE POL LOSSES (BY PRESS)		43.7%
AVERAGE POWER CONSUMPTION - H.P./O.D.T. FIBER/HR.		45.4

A standard perforated drainage cone was installed and the press operated one day, after which time the pinion failed in the gear box.

The average results of four sets of samples taken during this eighth day of operation are as follows:

	FINAL MILL	FRENCH PRESS
TONS CANE/HR. RATE	313	237
TONS FIBER/HR. RATE	31.8	24.1
POL IN BAGASSE	3.52%	2.14%
MOISTURE IN BAGASSE	54.25%	46.25%
EXP. JUICE PURITY	78.21	75.47%
AVERAGE MACERATION USED % TO WT. OF CANE		11.5%
AVERAGE REDUCTION IN BAGASSE POL LOSSES		50.9%
AVERAGE POWER CONSUMPTION - H.P./O.D.T. FIBER/HR.		41.7

After the "soft-tooth" substitute gearing was installed, the press was again placed in operation on February 27, and operated for a continuous two-week period. Due to the soft teeth in the gear box it was necessary to limit the horsepower usage to 475 H.P., and even then the teeth galled badly. The grinding rate through the press, as well as the hydraulic pressure on the discharge drainage cone, was reduced to the extent that the average grinding rate through the press was 11.5 oven-dry tons fiber per hour, pressing to an average residual moisture content of 53.6%.

The following tabulation is the average of 48 sets of samples taken during this run:

	FINAL MILL	FRENCH PRESS
TONS CANE/HR. RATE	364	113
TONS FIBER/HR. RATE	36.9	11.5
POL IN BAGASSE	3.50%	2.54%
MOISTURE IN BAGASSE	55.82%	53.60%
EXP. JUICE PURITY	78.78	75.43
AVERAGE MACERATION USED % TO WT. OF CANE (PRESS ONLY)		9.72
AVERAGE REDUCTION IN POL LOSSES (BY PRESS)		33.0%
AVERAGE POWER CONSUMPTION - H.P./O.D.T. FIBER/HR.		47.3

All of the data shown here from the 1966-67 U. S. Sugar operation were derived from U. S. Sugar Corporation's laboratory reports. The grinding rates shown for the press are a product of calculated material balances and are fairly accurate. A test was conducted during the period before the gear-box pinion failed, at which time the full 1500 H.P. of the main drive motor was available, wherein the 7-mill tandem was reduced to a grinding rate of 33 oven dry tons fiber per hour and 100% of the final bagasse was processed through the press for a period of one hour, during which time 1275 H.P. was being used.

Aside from the failure of the defective low-speed main-drive pinion, there were no other mechanical difficulties encountered in the Model K-70 press. Approximately 75,000 tons of cane were processed through the press and no wear on the pressing components was apparent, and no re-hardsurfacing was required to ready the machine for this year's crop.

During the off-season the entire gear train was replaced in the gear-box. In addition to increasing the H.P. rating throughout by 63%, the low-speed pinion was made integral with the low-speed drive shaft. Also, during the off-season, U. S. Sugar Corporation purchased a new turbine drive for the press, replacing the 1500 H.P. electric motor which they had rented as an expedient.

On the strength of the 1967 operation at U. S. Sugar, Osceola Farms Company of Pahokee, Florida and Ingenio de San Cristobal in Mexico ordered presses intended for operation during the 1967-68 season. Experience at San Cristobal will be covered briefly and at Osceola in more detail later in this paper.

The U. S. Sugar Model K-70 press began operation for the 1967-68 season on November 19, 19 days behind the balance of the mill. Once the turbine driven machine was placed in operation the advantages resulting from the turbine became apparent; it was now possible to start the press even if the machine had previously been shut down under full load. Such had not been the case with electric motor drives. Also, the variable speed feature of a turbine makes it convenient for handling variable production levels.

Between the 1967-68 season at U. S. Sugar and the previous one, extensive work on the milling equipment resulted in significantly increased production capability, about 8300 tons cane per day for the season just passed compared to about 8100 for the previous season. Early in the 1967-68 operation of the press it became evident that the turbine driven press running at a main shaft speed of 80 r.p.m. was capable of handling in excess of 8000 tons cane per day. There was one deterrent to doing this continuously, however, and this was the size of the motor driving the fast turning feed screw. This particular motor was 100 H.P. and would overload when throughput reached a rate of about 7500 tons per day. This overloading of the feedworm motor resulted in the backing out of the press discharge cone which would rapidly move back to its normal position when the feedworm motor load returned to some preset value under the overload condition. It was not considered ideal however to operate the equipment with frequent cycling of the cone since best extraction would not result. Therefore, press production was set

at 75-80% of total mill production. On several occasions the machine actually handled rates exceeding 9000 tons cane per day. For the 1968-69 season the feedworm will have 150 H.P.

For the most part the Clewiston press was operated at a rate of about 6500 tons cane per day with the turbine using about 1000-1100 H.P. - about 3.7 H.P. per ton cane per hour. In Table I may be seen the bagasse and juice analyses for the test period. The figures tabulated are averages arrived at by U. S. Sugar personnel from the daily laboratory reports. The pol reduction between the last mill bagasse and press bagasse amounts to 21%. This reduction was attained with 10.7% maceration based on cane. Maceration for the total cane handled averaged 14.97% for the season. Press extraction could have been improved by using more maceration ahead of it.

Table I. U. S. Sugar Corp. - Average Bagasse and Juice Analysis for Test Period

Dates	Mills					French Press				
	Bagasse		Juice			Bagasse		Juice		
11-17-67	Moisture	Pol	Brix	Pol	Purity	Moisture	Pol	Brix	Pol	Purity
THRU 3-16-68	54.99	3.45	6.94	5.35	77.09	53.47	2.87	4.10	3.00	73.17

Note: Extraction with Press - 94.68%
Extraction without Press- 93.27%

The press was operated during the past season with an operator or attendant, but it is felt that future developments and improvements will make this unnecessary. It is not known for sure what U. S. Sugar's plans are for the coming season in this regard, but Osceola plan to eliminate their operator. Actually, the press attendant at Osceola had additional duties. Also, the press at the Moore Haven Sugar House will not have an exclusive operator.

The press at U. S. Sugar processed 520,000 tons cane and operated 73% of the time after being placed in operation. Of the total lost time of 733

hours, 237 hours are to be attributed to items outside the press. The main cause of lost time with the press was three broken cone shafts with a total of 297 hours. This same failure was mentioned once in connection with the Quaker Oats presses. This cone shaft is approximately 25 feet long and is connected on one end to the hydraulic cylinder which loads it in operation and to the discharge cone on the other end. The original cone shafts were four inches in diameter and extended through a five inch diameter hole in the main shaft. In the operation of the press this cone shaft is in tension but also, in operation travels approximately the same eccentric path as the main shaft resulting in eccentric loads and a flexing or reverse stress situation, finally resulting in fatigue failure. This particular design was ideal for the Quaker Oats machines but is being changed for straight extraction operations. The new design will be essentially what we have on the smaller Model J-88 press, an outboard cone bracket at the discharge end of the press with the cone rod in compression. Figure 2 represents the outboard cone bracket design of the future.

Based on experiences at U. S. Sugar on 520,000 tons cane it is estimated that a full season's operation will require changing the final worm on the shaft 3 times, the next to last worm possibly once, and the discharge cone once. Also will be required some miscellaneous items bringing the total for reconditioning to an estimated $18,000. Handling 75-80% of Clewiston's total crop of 1,100,000 tons would give a unit repair cost of slightly over 2¢ per ton.

The French press at Osceola Farms Company started operations on November 27, 1967 and ran in very commendable manner for the balance of the season. The press was shut down for inspection of cage and shaft parts just after Christmas and for installation of a new fourth worm and cone

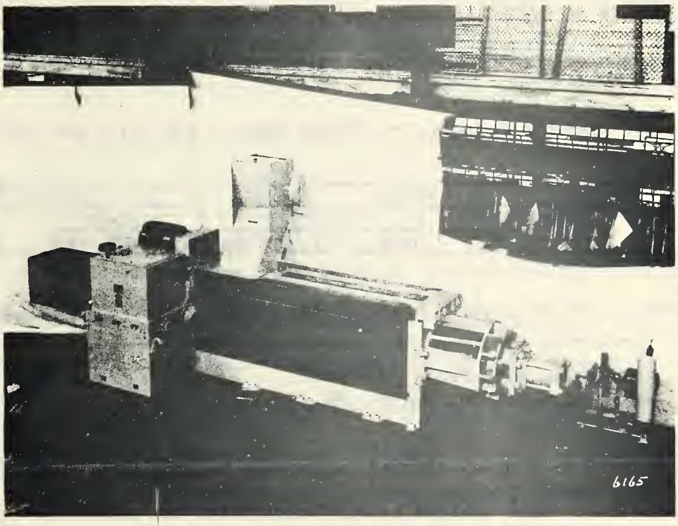


FIGURE 2 - FRENCH MODEL J-88 SCREW PRESS

shaft in March just before the end of the season. The press handled 515,000 tons out of 618,000 tons total, having started just 2 weeks after the balance of the mill. Table II shows bagasse and juice analyses for the test period. Sucrose extraction between last mill and press averaged just under 40% using 18.62% maceration. The press handled the total production per day of about 5,000 tons average. For the season just passed the machine was driven by a 1250 H.P. motor for which a turbine will be substituted next year. Main shaft speed of the press was fixed at 65 r.p.m. but will be variable next year within the limits of turbine speed variation.

Table II. Osceola Farm Co. - Average Bagasse and Juice Analysis for Test Period

Dates	Mills					French Press				
	Bagasse		Juice			Bagasse		Juice		
	Moisture	Pol	Brix	Pol	Purity	Moisture	Pol	Brix	Pol	Purity
11-27-67 THRU 3-20-68	54.44	3.89	6.38	4.84	73.68	51.94	2.59	4.18	3.00	71.62

Note: Extraction with Press - 94.0%
Extraction without Press- 90.1%

A Model K-70 press started operations in late April 1968 at Ingenio de San Cristobal. This machine handled about half the production rate of a 1,000,000 tons per season tandem. Average bagasse and juice analyses are shown in Table III. Extraction between the last mill and press averaged about 48%. Maceration was about 30% on cane which is about 16% fiber.

Table III. San Cristobal Mexico - Mill Vs. Press Bagasse Analysis and Juice Analysis

Dates	Mill					Press				
	Bagasse		Residual Juice			Bagasse		Residual Juice		
	Moisture	Pol	Brix	Pol	Purity	Moisture	Pol	Brix	Pol	Purity
4-28-68	52.80	3.09	4.39	3.48	79.27	47.15	2.19	2.37	1.75	74.16
4-29-68	53.97	4.09	4.29	3.20	74.59	48.15	2.09	2.07	1.47	70.97
4-30-68	53.80	4.25	2.91	2.22	76.29	47.97	2.24	2.57	1.83	71.43
5-1-68	51.60	3.92	3.63	2.83	77.96	47.11	2.42	1.96	1.49	75.84
5-2-68	51.10	4.04	5.06	3.92	77.47	47.66	3.00	2.43	1.87	76.94
5-3-68	53.02	4.55	4.62	3.62	78.35	49.35	2.63	1.97	1.49	75.48
5-4-68	52.46	4.31	4.63	3.55	76.67	48.43	2.46	2.41	1.80	74.85
Average	52.67	4.03	4.21	3.26	77.22	47.97	2.43	2.25	1.67	74.23

Before closing let me mention a little about equipment cost. A Model J press costs between $160,000 and $190,000 plus about $25,000 for installation and will handle up to 20 tons dry fiber per hour. A Model K press costs $265,000, installs for about $30,000 and will handle up to 40 tons dry fiber per hour. The above figures include drives and prime movers. The Model K presses can accommodate up to 1500 H.P. - the Model J's up to 1000 H.P.

Financial gain resulting from press operation at Osceola for the past season was about $290,000 in extra sugar and $8,000 in fuel oil consumption.

The ability of the French screw press to effectively dewater over-saturated bagasse to moisture contents of 50% and sometimes less make it a very effective means of increasing the efficiency of a milling tandem or for a given efficiency proportionately increasing grinding rate.

WATER QUALITY IN LOUISIANA
STREAMS RECEIVING SUGAR FACTORY WASTES

Robert A. Lafleur, Executive Secretary
Louisiana Stream Control Commission

The degree of water quality degradation in Louisiana's streams depends on the receiving stream. It is unfortunate, though quite significant, that sugar factory discharges are concurrent with low rainfall which results in low flows in several receiving streams. Approximately ten factories discharge their total waste to the Mississippi River; dilution and assimilative capacity of the river is, at this time, adequate. The other streams receiving sugar factory waste do not have a comparable capacity. In the area surrounding Thibodaux, Louisiana, Bayou Black, Grand Bayou, Bayou L'Onion, and intermittently Bayou Choctaw are most seriously affected by factory wastes; the same applies to the Jeanerette Canal and Bayou Tigre near Abbeville, Louisiana.

Bayou Teche receives as much as or more sugar factory waste than other streams and has the least assimilative capacity. The most affected part of the bayou is from New Iberia to the Adeline Bridge below Jeanerette, Louisiana. Table I indicates that during most of the 1967 grinding season dissolved oxygen did not exceed 1.8 ppm; the stream was completely depleted of oxygen during most of the season. Total, massive fish kills occurred, followed by septic conditions with characteristic noxious odors. This situation completely violates Paragraph (5) of the attached order issued by the Louisiana Stream Control Commission in 1955.

To comply with Public Law 89-234, commonly known as the Water Quality Act of 1965, the Louisiana Stream Control Commission developed, adopted, and submitted to the Federal Water Pollution Control Administration, water quality standards on the streams of this state. Among the water quality parameters

included in these standards is dissolved oxygen. The minimum level assigned to Bayou Teche is 50 per cent of saturation for the ambient water temperature, has been rejected by the U. S. Department of the Interior as being too low. Needless to say, dissolved oxygen levels at "zero" would be in complete violation of this standard.

Approximately eighty condenser water samples were collected from the ten sugar factories discharging to Bayou Teche during the past grinding season. Less than 25 per cent of the samples had a biochemical oxygen demand value (Table II) near the 50 ppm prescribed in the order mentioned earlier. These BOD values strongly indicate sucrose content at undesirably high levels, assuming that all cane wash water, spent caustic and acid was impounded. A review of the data collected during the past two or three grinding seasons indicates an increase in the "load" imposed on Bayou Teche as well as some of our other public waters.

It is recognized that some measures have been instituted which have not only improved conditions in the stream but have also resulted in some financial return to the factory operators through increased amounts of marketable sugar. Installation of mist eliminators for reduced entrainment in evaporators certainly is a classic example. Better general housekeeping to control floor sweepings, impoundment of cane wash waters, spent caustic and acids are other examples of improved waste control.

STATE OF LOUISIANA
STREAM CONTROL COMMISSION

ORDER

The Louisiana Stream Control Commission at a meeting held on March 11, 1955, and acting under authority granted by Chapter 3, of Title 56 of Louisiana Revised Statutes of 1950, as amended, issued the following order relative to the discharge of wastes from sugar mills located in the State of Louisiana.

I. No acid, acid water, alkali water, mill washdown water, effects condensate, filter press mud or liquid from filter press mud shall be discharged into state waters or drains or pipes leading to state waters during the grinding season.

II. No wastes impounded during the grinding season will be discharged until stabilization has taken place, until the biochemical oxygen demand has been satisfied, and then only into water volumes capable of assimilating such waste waters.

III. That all cane wash water shall be impounded for a period of not less than thirty days prior to discharge.

IV. That all cane wash water impoundments be compartmented so that the first compartment shall act as a settling basin. The design of the impoundments shall be approved in writing by the Stream Control Commission.

V. That, except in cases where specific order applicable to individual mills have been issued, that condenser water, that water used in barometric condensers, can be discharged into state waters provided first that not more than fifty parts per million of 5 day, twenty degree centigrade biochemical oxygen demand is added to the waters while being pumped through the condensers, and second that the condenser water not cause a serious oxygen depletion to take place in the receiving stream.

VI. That the Stream Control Commission shall, upon application, consider exception to this order and shall notify the applicant, in writing, of the action of the Commission.

This order shall be effective September 1, 1955, after having been published in the official journals of the parishes in which are found the several sugar mills.

BY ORDER OF THE STREAM CONTROL COMMISSION

L. D. Young, Jr.
C H A I R M A N

ATTEST:

Robert A. Lafleur
Executive Secretary

TABLE I

Dissolved Oxygen Values - Bayou Teche

1967 Grinding Season

DO (ppm)

Sampling Point	OCT 23	OCT 31	NOV 3	NOV 6	NOV 10	NOV 14	NOV 17	NOV 20	NOV 24	DEC 1	DEC 11	DEC 15	DEC 20
Railroad Bridge Breaux Bridge	4.4	5.8		5.0	4.2	3.0	4.0	4.0	4.0	4.2	3.8	4.2	3.8
City Bridge Breaux Bridge	4.2	4.8	4.0	4.6	4.0	2.9	3.8	3.8					
Bridge Parks, La.			4.0	4.0	4.0	2.8	2.4	1.8	1.8	1.8	2.5	3.2	3.8
St. Martinville Bridge		2.0	3.0	4.0	4.2	2.0	1.2	1.4	1.6	1.6	0	2.2	3.8
New Iberia City Bridge	0.0	1.4	1.8	1.0	0	0	0	0	0	0	1.0	1.6	2.6
Vida Bridge	3.0	1.0	1.8	2.0	1.5	1.6	1.5	1.2	1.4	1.5	1.7		
USDA Bridge near Jeanerette	1.6	1.0	1.8	0	0	1.5	0	0	0	0	0	1.0	2.0
Adeline Bridge	1.4	2.6	1.8	0	0	0	0	0	0	0	0	0	0
Franklin Bridge	5.4		4.2	7.0	5.4	5.4	4.0	5.6	6.0	7.2	6.2	2.8	4.0

TABLE II

Sugar Factory Discharges to Bayou Teche
1967 Grinding Season
Biochemical Oxygen Demand Values - BOD (ppm)

FACTORY	Oct. 25	Nov. 1	Nov. 6	Nov. 15	Nov. 20	Nov. 28	Dec. 5	Dec. 12
Breaux Bridge	21	+249	456	492	391	+540	+300	264
St. John	44	183	+245	+245	0	352	+150	288
Iberia Co-op	242	144	245	112	300	58	183	+471
Vida	286	440	657	600	320	249	735	Shut Down
Cajun Co-op	202	196	65	54	113	Sample Lost	39	---
Duhe Bourgeois	130	299	160	173	57	1	395	337
Delgado Albania								
(a) 10" pipe	1	75	29	24	Samples Lost	73	38	24
(b) Ditch	80	79	24	50	"	79	58	3
St. Mary Co-op	16	62	195	62	94	97	92	101
Columbia	21	25	34	13	0	1	0	38
Oaklawn	100	118	116	1	31	1	56	13
Enterprise		449	193	305	216	+450	+300	+459
Southdown	49					47		

EVALUATION AND TIMELY UTILIZATION OF SUGARCANE VARIETIES

George Arceneaux, Director
International Research Service

Improved varieties of sugarcane developed in programs of controlled breeding have accounted for major advances in the efficiency of field production during the recent past. Unlike other means of increasing production of sugar per acre, such as use of more fertilizer or more intensive irrigation, the replacement of old varieties with better ones can be done without cost except that of the underlying research. It is not surprising therefore that sugarcane breeding should be receiving so much attention the world over and that varieties developed at breeding stations are now dominating the scene (1).

In order to qualify for commercial use, a new seedling must meet many demanding requirements and the ratio of such an individual to total original numbers is very small indeed, often in the ratio of 1:100,000 or even smaller. Besides producing seedlings in extremely large numbers, we must meet the much more important problem of identification and evaluation in our quest for better canes. These superior new varieties do not come to us labeled with conspicuous tags for all to see, but instead, must be sought from among the others and evaluated over years of painstaking study. It is very much like looking for the proverbial needle in a haystack. Sugarcane breeders have been glamorized for their part in the development of new varieties, but the role of the agronomist in the intricate and important business of variety evaluation is not generally appreciated.

The length of time between the germination of original seedlings and the ultimate selection of survivals for commercial culture will ordinarily

require from seven to ten years. In the beginning it is largely a matter of boiling down numbers to the point where the residue can be economically managed in comparative yield trials. Following this, the sequence of tests must provide an accurate evaluation of the variety as a candidate for commercial culture.

During the first three years seedlings are ordinarily planted in single plots, consisting necessarily of single stools during the first year and increasingly larger plots during the second and third years. At each yearly stage, it is essential that as many as possible of the seedlings be eliminated without running the risk of passing up what might prove to be a useful variety. With the large numbers involved it is not practical to make and record highly detailed observations; hence, procedures of evaluation at this stage should be simplified as much as is consistent with reasonable accuracy.

In our initial selection work, we are faced with two important problems viz: (a) the personal views of the selector as to what constitutes the ideal variety and (b) random variations due to environmental factors. Importance of the subjective factor in early stages of selection can be easily demonstrated by having four or five selectors to grade independently the same group of seedlings in a nursery planting. There will ordinarily be scant agreement as to what constitutes the best 1%, the best 5% or the best 10%. This points up the advantage of a system of multiple scoring by different selectors as a basis for final selections. Random variations in growth arising from micro-differences in the environment are reflected in the wide differences commonly observed between stools of the same variety in any given field. The point here is: just how accurately does one stool or even several consecutive stools reveal the agricultural potential of the variety?

Some sort of grading system integrating overall growth qualities of selected seedlings will be helpful for future reference. In my own work I have found it satisfactory to use a scale ranging from one to ten with the check variety taken as five. I have also found it advantageous to supplement visual ratings with actual cane weight records on single plots of stage III. Brix determinations by refractometer have been found extremely useful in each of the first three stages. Rates of selection and reselection will obviously depend on quality of the particular progeny, but generally speaking, retention ratios in the neighborhood of to 1:10 may be considered safe for each of the first three stages.

By the end of the third year, reselections will be sufficiently reduced in number for replicated field trials. At this stage designs such as randomized blocks will be satisfactory under Louisiana conditions with seedling groups of 25 or less. In the case of larger groups, arrangements with lattice restrictions (incomplete blocks) are recommended. In the Caribbean area (Cuba, Dominican Republic, Puerto Rico) soil variations are such that I would recommend an appropriate lattice design to permit a correction for intra-block variations, and it would be preferable to limit the number of seedlings to a maximum of 25 or 30 in individual experiments.

In the later stages (V to IIX, IX or X), a 6 X 6 Latin square makes a manageable experiment and with uniform stands will give an acceptable level of statistical accuracy under almost any soil conditions. It is ideally adapted to alluvial soils of Louisiana where our principal sources of variation are (a) distance from the field ditch, and (b) distance from the parent alluvial stream.

Disease Resistance

Disease control has implications in several disciplines but I regard it essentially as a genetic problem. In breeding new varieties, we should strive for complete resistance with the aim of wiping out the particular disease, but in some cases circumstances may dictate a compromise. This is illustrated by the following two diseases of importance in Louisiana.

A high order of resistance to red rot is rare in the genus Saccharum and we are having to be satisfied with something less than complete resistance in our commercial varieties. In combatting mosaic, on the other hand, we have at our disposal a high order of resistance in many forms of the genus, and as a result, adaptable varieties resistant to mosaic are now available for culture in most of the world's producing regions. In some cases however, as for instance in Louisiana, it is necessary to use locally susceptible varieties in which mosaic-spread is relatively slow. This requires continued effort to keep the disease in check. At best, this should be regarded as a temporary expedient until completely resistant varieties can be developed. The principle of "gradualism" is not any more attractive in fighting plant diseases than in waging a war.

The concept of mosaic tolerance as an end is even more objectionable. Continued cultivation of heavily infected varieties can raise the local virus pool to dangerous proportions, and in addition such varieties can be expected eventually to capitulate to the disease. I do not know of a single variety that has been successfully cultivated after becoming 100% infected with mosaic.

Tests of Milling Qualities

In comparing varieties of sugarcane we are concerned primarily with production of sugar per acre. The basic information on available sugar

per ton of cane will ordinarily consist of Brix and pol determinations on primary juice. An empirical formula employed to give an estimate of available sugar per ton of cane must assume certain values for volume of extractable normal (absolute) juice per ton of cane and for the change in composition from crusher juice to normal juice (Brix and sucrose reduction factors). Since sugarcane varieties now being bred differ widely as to fiber content and possibly other qualities affecting results of milling, it is obviously ridiculous to apply statistical constants with their implied precision to calculated yields of sugar without bringing such varietal variables under experimental control.

In attacking the problem of varietal differences in milling qualities as affecting results of agronomic tests we developed at the Houma station, a method whereby varietal milling qualities are determined by crushing small lots of cane to factory levels of sucrose extraction through repeated milling under hydraulic pressure and the use of maceration water.

Details of the method have been given in earlier publications (2, 6, 9), hence a brief summary here is considered sufficient. All new varieties are compared with the same control variety in repeated tests. Critical data used in the interpretation of results are, normal juice extraction % cane, sucrose reduction factor and fiber % cane. A uniform Brix reduction factor of .985 is assumed in all cases. This does not introduce a bias since normal juice extraction % cane and Brix reduction factor are complementary functions of extracted solid, the critical value actually observed. Combined effects on available sugar per ton of cane of differences in normal juice extraction % cane and sucrose reduction factor between the new variety and the control are integrated into a single number designated as the varietal correction factor (VCF). Fiber % cane determined in each case gives a good check on

the VCF calculation. Since our original publication 35 years ago, experimental milling tests employing the Houma Station method have been conducted, Florida, and other regions. An analysis of results support the following generalization:

1) The value of a varietal correction factor (VCF) is controlled largely by the varietal difference in fiber content but is affected secondarily by the difference in sucrose reduction factor.

2) Although the actual level of fiber content in a given variety may vary widely depending on environmental conditions and other variables, the relationship between any two varieties will tend to approach a constant. This is also true of sucrose reduction and thus of the VCF value as well.

3) In an analysis of extensive experimental milling data obtained under Louisiana conditions the VCF for any given variety was not affected by differences in soil conditions, crop (plant cane or stubble) or weather conditions between years. In this connection the following tabulation from earlier publications (2, 5, 7) giving the order of precision and statistical limitations of measurements on components of sugar per acre as obtained in variety tests by U.S.D.A. in Louisiana is considered pertinent:

Individual components of varietal sugar yield per acre	Coefficient of variability	Interaction deviation due to effect of:	
		locality	year
Cane per acre	9.42 (a)	**	**
Juice composition	4.14 (a)	*	*
Milling quality (VCF)	1.71 (b)	not sign.	not sign.

(a) after adjustment for variety effect and primary interactions.
(b) after adjustment for variety effect only.
** Highly significant
* Significant

It is obvious from the above that sources of error in determinations of sugar per acre are primarily in measurements of cane per acre followed by variance in analyses of the juice. The other component, milling quality of cane as integrated in VCF showed a much lower order of variability and what is still more important, was not subject to interaction deviations under the range of environmental conditions within the region. The significance of this is that a VCF value when determined to the required level of precision may be generalized and applied uniformly in routine calculations. In fact, such a term for the purpose of varietal comparisons is much more accurate than measurements of juice extraction and other milling factors in individual experiments.

In a recent study by Hebert and Davidson (10) correction factors for a group of varieties were determined (a) under Louisiana conditions and (b) under Florida conditions. On the whole, the VCF of any given variety did not vary greatly between the two regions but there was some evidence of inter-regional interaction. This bears out results of some of my own varietal milling studies in Cuba and the Dominican Republic (unpublished). Thus, whereas indications are that varietal differences in fiber content and other milling qualities will tend to persist under a wide range of growing conditions, it may be assumed that radical differences in the environment could affect relative varietal positions; hence, we recommend that a set of VCF values be determined for each region of production.

Use of generalized correction factors to compensate for varietal differences in milling qualities has important advantages over other methods in use. In comparison with C.C.S. adjustments for fiber content as made in Queensland the VCF method corrects, in addition, for varietal differences in purity drop between crusher juice and normal juice. It has a similar

advantage over the elaborate and laborious pol ratio method of Hawaii and permits a much more efficient use of research facilities and personnel. A team of two technicians can make about 20 pol ratio determinations a day (11).

Routine Sugar Yield Calculations

Juice composition as a basis for sugar yield determinations is ordinarily expressed in terms of Brix and percent sucrose (pol). These must be converted to available sugar per unit weight of cane for statistical analysis. The need for a rapid and accurate method of making such calculations is obvious. In a previous paper (8) it has been shown that the widely used Winter-Carp formula can be simplified to the following expression:

$S' = (Sx) - (By)$ in which:

S' = Available 96° sugar per ton of cane.

S = Percent sucrose content of primary juice

B = Brix of primary juice

x = Calculated factor

y = Other calculated factor

The calculation is greatly simplified and readily adapted to mechanical calculation by avoiding the non-linear factor introduced in the original equation by use of the term purity. It has also been shown that other yield equations such as the C.C.S. formula of Australia and the S. E. (Sucre extractible) formula of Reunion can be readily converted to terms of the simplified $(Sx) - (By)$ expression (3).

Timely Utilization

Because of the slow annual rate of seed multiplication, timely use of new varieties will be expedited by some system whereby a program of

seed-increase is coordinated progressively with results of variety tests and in this connection the excellent program now operating in Louisiana could very well serve as a model to other regions.

The original three-way agreement on breeding and testing sugarcane varieties between USDA, LSU and the American Sugar Cane League inaugurated in 1926 made scant provision for increase and distribution of seed cane. The increase program as we know it today was developed by slow evolution over the years through the joint efforts of many individuals from the three cooperating agencies.

It was evident to us from the beginning that some plan had to be followed whereby promising varieties would be selected for systematic increase over a period of several years in advance of actual release. This will necessarily involve a rather wide selection in the early stages of testing followed by reselection of certain ones for further and further increase as results of tests become more and more conclusive. In other words, actual increase must be geared to results of variety tests.

Provisions of the increase arrangement with growers are based primarily on two considerations viz. (a) A major portion of the seed supply at time of release should be available for distribution among other interested growers and (b) the proportion of the seed supply to be reserved for the increase grower must be sufficiently large to maintain his active interest and to justify a special effort for rapid increase. Provisions now in force reserve 25% of the seed supply at time of release for the increase grower. Five percent is reserved for free distribution to small growers in lots of ten stalks each. The remainder is available for sale to other growers at cost of distribution plus fair field value, the latter going to the increase cooperator. The entire program of seed increase and distribution is administered by the American Sugar Cane League.

At first the increase of promising varieties consisted of plantings from surplus seed at outfield variety test stations. Later on, increase stations were established on plantations of other growers in order to provide more distribution points. Finally this evolved into the present system of primary and secondary increase stations. A fairly large number of varieties are placed on increase at primary stations; when release of variety is contemplated, it is introduced for increase at the secondary stations as well.

As mentioned earlier, increase activities should be closely coordinated with results of the variety test program. In Louisiana this is done by representatives of the League in consultation with research workers of U.S.D.A. and L.S.U. Each year in advance of the planting season, certain varieties are selected for primary increase with a suggested limit of increase. Varieties selected for the secondary stations are ordinarily recommended for unlimited increase.

The list of men who have had a hand in the development of the Louisiana variety increase program as we know it today is a long one indeed. Under the circumstances one hesitates to mention names, but I cannot conclude this topic without citing the name of Elliott Jones. Mr. Jones has left his stamp on much that has been accomplished in the cooperative variety program under the now famous Three-Way Agreement, and especially on the growth and development of the seed increase project. As a leading member of the League Contact Committee for many years, he had much to do with the planning and implementing of seed increase activities. He was also a keen judge of varieties and no matter how hot the day, he was usually there in the field with us when varieties were being selected for increase or release.

Varietal "Deterioration"

We all know that the productive capacity of a given variety may change greatly in the course of time. The term "varietal deterioration" as commonly used is not appropriate inasmuch as all available information places the primary cause in the environment rather in the variety, but regardless of factors involved, it is of great practical importance to detect loss of productive capacity in a commercial variety as promptly as possible. Use of interaction statistics applied to the regression equation to measure a time-related change in relative varietal production has been proposed and illustrated in previous publications (4, 7). The following summary gives results of such an analysis of data obtained in Louisiana under conditions when some of the varieties in our tests were in the process of "deteriorating."

Variety	Variety X year interaction deviation (Cane per acre % general mean)				Linear regression	
	1937	1938	1939	1940	Observed	As compared with C.P.29-116
C.P.29-116	-7.8	+0.2	+3.4	+4.2	+9.76**	-
Co. 281	+0.4	-7.4	+1.7	+5.3	+5.96**	3.80
C.P.28-11	-1.4	+0.7	-5.2	+5.9	+3.96	- 5.80*
C.P.28-19	+1.1	+2.4	-3.0	-0.4	-2.48	-12.24**
Co. 290	+2.5	+4.4	+0.9	-7.7	-8.56**	-18.32**
C.P.29-320	+5.2	-0.3	+2.3	-7.2	-8.61**	-18.37**

*Significant at .05 probability.
**Significant at .01 probability.

The analysis of interaction variance as commonly made merely provides a test of statistical significance of the overall trend. As shown by the above tabulation, this can be broken down to the interaction deviation of each variety in relation to time. The change for any given variety may be taken as a measure of the change in its relative performance over the period. The regression equation provides a test of statistical significance. Details

of calculating the statistical constant shown and their interpretation are given in an earlier publication (7).

Varietal differences as to the order of deviation in relation to time followed widely different regression patterns. The rising trend in the case of C.P.29-116 is taken as reflecting the least change in absolute production since there is no basis to assume an increase in yield capacity. Varieties such as Co. 290 and C.P. 29-320 showing significantly opposite trends are assumed to have lost proportionately in productive capacity. The linear regression as compared with C.P. 29-116 provides a critical quantitative measure.

Admittedly, results of such an analysis are of greater significance for diagnosis than for prognosis, but our experience shows that this approach permits a much earlier detection of a retrogressive change as to varietal performance than would be possible from an examination of varietal yield records individually. It is obviously necessary that the group under study should include at least one variety of reasonably stable performance.

Summary

A variety of commercial merit is a rare occurrence in original progenies and must be identified and evaluated in a sequence of tests commonly extending over a period of seven to ten years. Tests during the early years are essentially weeding operations in which seedling selections are reduced to manageable numbers for more critical field trials. At this stage there is a large subjective element in individual appraisals adding further to errors of random variations in field performance of single stools of original nurseries and necessarily small, usually single plots during the next two years.

At this stage detailed records of individual varietal characters are not indicated but some sort of grading system giving an overall estimate of agricultural merit has been found useful. Refractometer Brix determinations are also recommended. Because of the large factor of error during the early years, extremely close selection should be avoided.

Replicated field experiments can advantageously begin during the fourth year (Stage IV) with fairly large groups in individual tests. Under Louisiana conditions arrangements in randomized blocks are recommended for groups up to 25. For larger numbers in the same experiment I would recommend some sort of lattice arrangement to permit an adjustment for intra-block variations. For the more advanced tests I would recommend groups of six varieties in Latin square arrangement.

Milling tests on laboratory scale in Louisiana and elsewhere have shown that a varietal correction factor calculated according to a method developed at the Houma Station will give an accurate adjustment for varietal differences in fiber content and other characters affecting milling qualities. Such a factor computed for any given variety in comparison with the same control was essentially a constant under a wide range of conditions in Louisiana. For the purpose of varietal comparison, use of generalized VCF values that have been accurately determined for a given region is considered more accurate than adjustments based on a separate determination of juice extraction or fiber content in each experiment.

Simplification of the Winter-Carp formula to the basic equation $S' = (Sx) - (By)$ as defined in this report with further adjustments of x and y for the varietal correction factor permits rapid machine calculation of available sugar per ton of cane.

The Louisiana system for seed increase in coordination with the progress of variety tests is cited as a model, and a brief history of its origin and development is given.

A statistical analysis based on variety x year interaction deviations over a period of time applied to the regression equation is proposed as a mathematical approach to measure "varietal deterioration" from results of a long-term group experiments with sugarcane varieties.

Literature Cited

1. Arceneaux, G. 1965. Cultivated sugarcanes of the world and their botanical derivation. Proc. 12th Cong. ISSCT: 844-854.

2. ____________, and L. P. Hebert. 1954. Calculation of sugar production from sugarcane variety tests. Sugar 49: 50-53.

3. ____________. 1956. A universal equation for indicated available sugar in cane. Proc. 9th Cong. ISSCT. Vol. II: 737-749.

4. ____________. 1953. Some neglected aspects of experimental procedure in making comparative tests of sugarcane varieties. Proc. 8th Cong. ISSCT: 431-440.

5. ____________, and L. P. Hebert. 1948. Locality effect on comparative yields of cane and sugar under Louisiana conditions. Sugar Bul. 26: 406-407.

6. ____________. 1945. Generalized factors for computing varietal yields of sugar from results of field tests with sugarcane. Sugar Bul. 23: 186-191.

7. ____________, and L. P. Hebert. 1943. A statistical analysis of varietal yields of sugarcane obtained over a period of years. Jour. Am. Soc. Agron. 35(2): 148-160.

8. ____________. 1935. A simplified method of making theoretical sugar yield calculations in accordance with the Winter-Carp-Geerligs formula. Int. Sug. Jour. 37: 264-265.

9. ____________, C. C. Krumbhaar and R. B. Bisland. 1933. Testing cane to determine probable milling yield. Facts About Sugar 28(9): 350-353.

10. Hebert, L. P. and L. G. Davidson. 1968. Milling quality of sugarcane varieties in Louisiana and Florida. Proc. 13th Cong. ISSCT (in press).

11. Payne, J. H. and J. H. Mahon. 1956. The pol ratio method for evaluating cane quality. Proc. 9th Cong. ISSCT Vol. II: 436-447.

BIODEGRADATION OF LIGNO-CELLULOSE IN SUGAR CANE WASTE

Robert E. Druilhet, Joe B. Bradburn, and Wilma A. Subra
Department of Veterinary Medicine
Gulf South Research Institute
New Iberia, Louisiana 70560

Some 750,000 to 1,000,000 tons of bagasse are produced annually as a fibrous by-product from Louisiana sugar mills. The disposal of this by-product, a result of sucrose extraction from sugar cane, is becoming a major problem to the sugar industry. In an attempt to find a commercial market for bagasse, GSRI for the past 18 months has investigated the feasibility of using bagasse as a ruminant ration in the Louisiana agriculture industry. In September 1966 the Louisiana State Science Foundation awarded a grant to GSRI to investigate the feasibility of using bagasse as a ruminant ration.

Problems in the use of bagasse as a ruminant ration include such questions as (1) does the pesticide residue level in the bagasse fall within the levels recommended by the Food and Drug Administration for animal feed? (2) Does bagasse possess potential nutritional qualities? and (3) Are ruminants capable of utilizing bagasse as a source of energy?

To solve the first problem, GSRI's Department of Toxicology under the direction of Dr. Thomas E. Shellenberger examined the pesticide levels present in the 1967 season bagasse (Fullerton, et al., 1968). The overall average of pesticide residues was found to be 10.2 ppb DDT and 3.4 ppb endrin. No other pesticides were detectable with the exception of one sample showing a small amount of dieldrin and a few samples suggesting low residues of heptachlor epoxide. Thus, the chlorinated pesticide contents of bagasse were found to be sufficiently low as to pose no problem in its use as an animal feed.

To ascertain the potential qualities of bagasse, we analyzed the bagasse according to the quantitative and qualitative procedures set forth in the Official Methods of Analysis of the Association of Official Agricultural Chemists (10th edition). A crude chemical analysis of bagasse reveals it to be a heterogeneous material. It is composed mainly of the energy-rich carbon compounds, celluloses, hemi-celluloses, and lignin. In order to compare crude bagasse to a commercial animal ration, we determined the crude protein, fat and fiber content of the bagasse along with the concentration of α-cellulose, residual sugars, and trace metals. The results of these analyses are given in Table 1. These data indicate that bagasse possesses many characteristics of a potential ruminant ration, if the high crude fiber content and the absence of crude protein can be overcome. It was thought that these two drawbacks could be resolved by using microorganisms which would degrade the crude fiber and lend their microbial protein to supplement the bagasse.

Table 1

CHEMICAL COMPOSITION OF BAGASSE

Component	Percentage
Crude Protein	0
Crude Fat	4
Crude Fiber	87
α-Cellulose	62
Residual Sugars	15
*Trace Metals	0.08

*Cobalt present @ 4 μg/g.

The trace metal and α-cellulose composition of the bagasse was very promising. Ruminant animals are largely independent of a dietary source of the B complex vitamins, with the exception of B_{12} due to the synthetic activity of the prodigious microflora of the ruminant intestines. Even B_{12} can be synthesized by the microflora if cobalt is present in the ruminant diet. The cobalt content of bagasse is sufficient to activate the synthesizing of B_{12} by the microflora of the ruminant.

The ruminant has a unique ability to utilize large quantities of cellulose and hemi-cellulose, due chiefly to the enzymatic action of interruminal microorganisms. The rumen microbiota use these structural carbohydrates as substrate for growth. The result is an increase in cell mass or protoplasm and the accumulation of metabolic products, chiefly short-chain fatty acids (Baker and Harriss, 1947). These products are adsorbed and/or digested by the animal as a source of energy. Investigators have shown that approximately 1/2 gram of short-chain fatty acids are produced per gram of cellulose fermented (Carrol and Hungate, 1954).

The adverse effect of lignin on the microbial digestibility of forage cellulose and hemi-cellulose has been directly implicated in numerous investigations (Crampton and Maynard, 1938; Forbes and Garrigus, 1950A and 1950B; Walker and Hepburn, 1955; et al.). The concensus is that the indigestible lignin acts as a physical barrier between cellulose or hemi-cellulose and the microbial enzyme cellulase or hemi-cellulase. Therefore, the degree of plant lignification will have a direct bearing on the amount of cellulose available as a potential energy source. Since bagasse contains approximately 30 to 40 percent lignin or ligno-cellulose, lignin coexisting with cellulose fractions of the plant, this quantity of potential foodstuff is inavailable for conversion to a usable form. If, however, the lignins or ligno-cellulose components were

destroyed, the potential food value of bagasse would be nearly doubled. Thus, the problem we faced was the delignification of the ligno-cellulose material, bagasse.

The microbial delignification of plant material has been known for many years. More than 2,000 species of microorganisms are presently classified as lignin degraders with the majority of the organisms being in the order Basidiomycetes. The remaining microbes are Ascomycetes, soil and water microbes, and some microorganisms endogenous to the intestinal tract of certain animals. This natural microbial delignification is not industrially applicable, however, due to the slow rate at which it proceeds.

In an effort to speed up this natural process, we have attempted to elucidate the ideal environmental conditions necessary for lignin utilizing microorganisms to metabolize bagasse lignin.

The bacteria used in this study were originally isolated from soil and water samples taken from areas surrounding sugar cane operations. The enrichment culture technique was used to select potential lignin degrading microorganisms. One milliliter of an aqueous dilution of the soil and water samples was inoculated into 50 milliliters of a basal salts-lignin medium. After a 10-day period of incubation of 30°C, each enrichment culture vessel was streaked for the isolation of viable organisms. These isolates were maintained as stock cultures on Trypitcase Soy Agar (TSA) at 30°C.

The classification of all isolates was made according to Bergey's Manual of Determinative Bacteriology. Classification studies revealed two of our isolates to be Micrococcus roseus and Pseudomonas aeruginosa.

Cells from 24-hour old cultures were used as the inoculum in all experiments. The inoculum was prepared by washing TSA slants with sterile phosphate buffer three times with centrifugation between each washing to remove residual

carbohydrates. The final cell suspension was adjusted with sterile phosphate buffer to a turbidity of 400 Klett units using a Green No. 54 filter. One milliliter of this standard cell suspension was used as the inoculum for each 50 milliliters of medium.

The ingredients and quantities of the medium components which made up the chemically defined medium with which these experiments were conducted is given in Table 2. The incorporation of the trace elements in our medium was felt necessary due to the use of deionized water in the preparation of the medium. This supplementation was considered important in the activation of certain enzymes such as hydroperoxidases and phenaloxidases.

An environmental control incubator set at 150 rev/min was used in all shake culture experiments.

Prior to the isolation of our substrate lignin from bagasse, the extraneous components of bagasse, such as lipids, resins, and organic acids, were removed to avoid possible contamination of the isolated lignin. Following a thorough washing with water, the mulched bagasse was extracted with one part ethyl alcohol and two parts benzene. This extraction was followed by an extraction with hot water at 70°C for 20 minutes and filtering. The filtrate was tested for the presence of carbohydrates by the Anthrone Method of Loewus (1952). The water extracts were continued until a negative carbohydrate test was obtained. The washed bagasse was then dried in a desiccator with silica gel as the desiccant.

The carbohydrate-free bagasse was used in several lignin extract methods. The Caustic Soluble method was chosen as the method of choice due to its high lignin yield and its ease and speed of extraction. One hundred and fifty grams of bagasse were placed in a dry 500 milliliter Erlenmeyer flask to when was added 200 milliliters of 1 percent NaOH. The mixture was

Table 2

BASAL SALTS-LIGNIN MEDIUM

Ingredient	Grams/Liter
C as Lignin	0.200
N as NH_4NO_3	2.500
PO_4 as KH_2PO_4	0.500
PO_4 as Na_2HPO_4	1.000
Mg as $MgSO_4 \cdot 7H_2O$	0.500
TRACE ELEMENTS	
Ca as $CaCl_2 \cdot 2H_2O$	1×10^{-2}
Fe as $FeSO_4 \cdot 7H_2O$	1×10^{-3}
Zn as $ZnSO_4 \cdot 7H_2O$	1×10^{-4}
Cu as $CnSO_4 \cdot 5H_2O$	1×10^{-5}
Mn as $MnSO_4 \cdot H_2O$	1×10^{-5}
Mo as $NaMoO_4 \cdot 2H_2O$	1×10^{-6}
Co as $CoCl_2 \cdot 6H_2O$	1×10^{-6}
B as H_3BO_3	1×10^{-6}

pH 7.0

placed in a boiling water bath for 30 minutes and filtered. The lignin was then precipitated from the filtrate until it attained a pH of 2 using 3 N HCl. The precipitate was centrifuged and the supernatant decanted. The centrifugate was suspended in a liter of distilled water and agitated for one hour. The lignin was centrifuged and air dried in the presence of ethylalcohol. The dried lignin was ground into powder form to be used as experimental substrate.

Infrared spectrophotometry was used in the comparison of our lignin extracts with commercially available lignin. A Perkin-Elmer 457 prism-grating infrared spectrometer was used for all infrared analyses. Spectra of solid samples were measured by the KBr technique in discs of 13 mm diameter. Each disc contained 1.5 mg of sample in 300 mg of KBr. Figure 1 shows the infrared spectra of our lignin to correspond closely with Kraft-Spruce lignin.

With the isolation and partification of bagasse lignin, we examined some physiological parameters of Micrococcus roseus and Pseudomonas aeruginosa when grown in a chemically defined medium with lignin serving as the sole carbon and energy source.

Growth experiments showed both isolates to exhibit an extended lag phase which suggests some adaptive process is necessary before either isolate can utilize the lignin as a sole carbon and energy source.

A lignin dehydrogenase system was analyzed for by the Thunberg technique. The use of this technique with washed intact cells, though giving only limited information, is exceedingly useful in preliminary studies on bacterial metabolism as indicating what molecules of a substrate are usable by the organism in question. The results of these experiments (Fig. 2) showed that Micro. roseus has a very active lignin dehydrogenase as indicated by the methylene blue reduction time. However, no detectable lignin dehydrogenase system was found present in Ps. aeruginosa. This datum suggests a difference in the attack of these two bacteria on the lignin molecule.

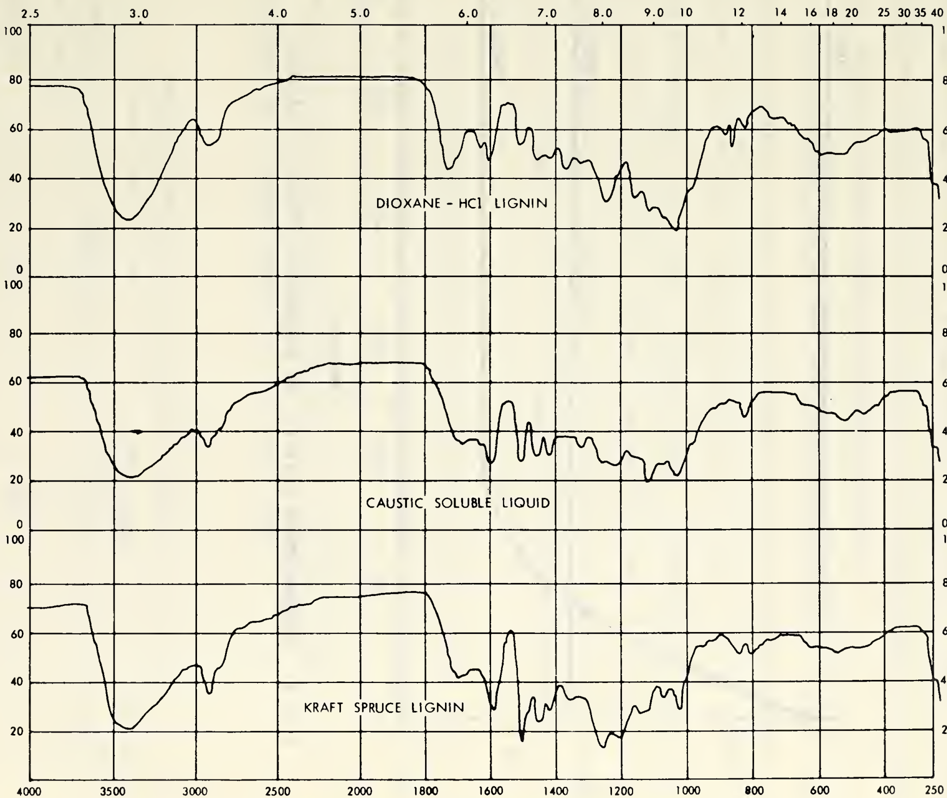


Figure 1. INFRARED COMPARISON OF CAUSTIC SOLUBLE BAGASSE LIGNIN AND KRAFT - SPRUCE LIGNIN

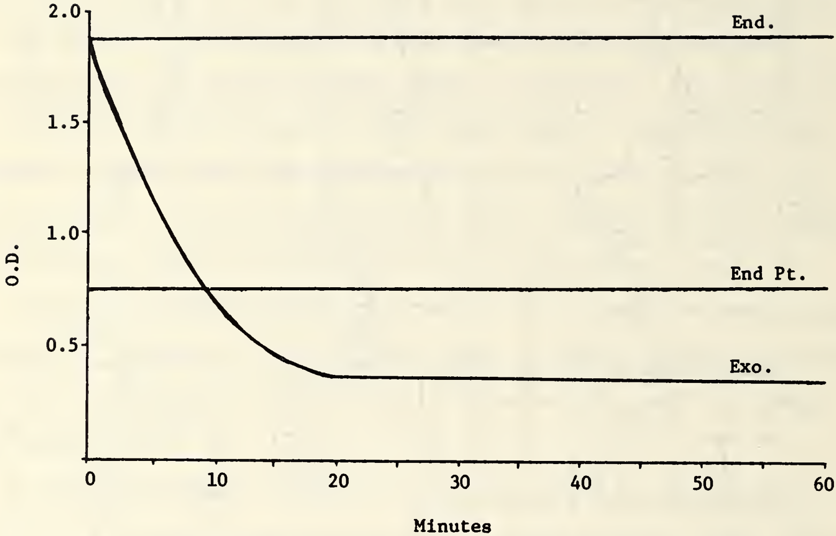


Fig. 2 DEHYDROGENASE ACTIVITY OF *MICROCOCCUS ROSEUS* ON LIGNIN

While the physiological data were somewhat preliminary, we felt that Micro. roseus and Ps. aeruginosa were used as the test organisms and bagasse served as the sole carbon and energy source. The culture vessels were incubated at 30°C for two weeks. At this time the experiment was stopped and the biodegraded bagasse analyzed and compared to crude bagasse and a commercial feed. Results of these analyses are given in Table 3.

Animal feeding trials were initiated with the biodegraded bagasse and the crude bagasse. Spregue Drawley albino rats were the first animals studied. They were fed crude and biodegraded bagasse for 14 days. At the end of this time 100 percent of the albino rats were dead. A pathological examination of the dead animals revealed no malnutrition and death was attributed to foreign body pneumonia due to inhalation. Forty percent of the rats in the bio-bagasse fed group succumbed at the end of 14 days. A postmortem attributed death to mycotoxins.

With the salient data gained from the small animal feeding trials, death due to foreign body pneumonia and poisoning by fungal toxins, large animal feeding trials were begun. The data from these feeding trials have not been compiled at this time but will be available in our final report to the Louisiana State Science Foundation in October 1968.

Table 3

COMPARISON OF CRUDE AND BIODEGRADED BAGASSE WITH A COMMERCIAL FEED

Component	Bagasse	Biodegraded Bagasse	Commercial Feed
Crude protein	0%	14%	16%
Crude fat	4%	4%	3%
Crude fiber	87%	49%	8%
NFE	5%	30%	54%
Trace minerals	0.08%	0.06%	0.05%

REFERENCES

Baker, F., and S. T. Harriss, Nutr. Abstr. Rev., 17: 3-12, 1947.

Carroll, E. J., and R. E. Hungate, Appl. Microbiol., 2: 205-214, 1954.

Crampton, E. W., and L. A. Maynard, J. Nutr., 15: 383-395, 1938.

Forbes and Garrigus, J. Anim. Sci., 9: 354-362, 1950A.

Forbes and Garrigus, J. Anim. Sci., 9: 531-539, 1950B.

Fullerton, F. R., L. A. Escuriex, and T. E. Shellenberger, Personal communication, 1968.

Loewus, F. A., Analyt. Chem., 24: 219, 1952.

Walker, D. M., and W. R. Hepburn, J. Agric. Sci., 45: 298, 1955.

MINUTES, ANNUAL MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

FEBRUARY 1, 1968

The Annual Meeting of the American Society of Sugar Cane Technologists was held on Thursday, February 1, 1968, at the White House Inn, Baton Rouge, Louisiana.

The meeting was called to order by President Thomas Allen. He acknowledged the adequacy of the arrangements, the excellent attendance and made several announcements concerning registration, the banquet and also noted that there would be special awards presented at the banquet.

President Allen presented Connie Melacon, Chairman of the Manufacturing Section, who in turn introduced the following program:

Application of the Two Boiling System for Louisiana	T. R. Ray T. R. Ray, Inc. Baton Rouge, Louisiana
Automated Bagasse Bale Handling	Albert I. Guidry Chief Chemist South Coast Corporation Houma, Louisiana
Bulk Storage of Bagasse	D. R. Bernhardt Valentine Pulp & Paper Co. Lockport, Louisiana

Chairman Melacon presented certificates of appreciation to the program participants.

There followed a business session. Items discussed are as follows:

(1) A financial statement was presented by Denver T. Loupe, Secretary-Treasurer and approved as distributed.

(2) A report by Larry Lampo from a "Special Committee" concerning Louisiana hosting the XIV Congress, ISSCT in 1971.

(a) Moved that ASSCT offer itself as host for the 1971 Congress. Approved. Comments by President Allen of the possibility that Florida would host a Post-Congress Tour.

(b) Moved that the names of W. S. Chadwick for General Chairman and Denver Loupe for General Secretary-Treasurer be placed in nomination for the 1971 Congress. It was further approved that Denver Loupe be authorized to negotiate for a person to serve as General Vice Chairman.

(c) Moved that authority for further action on XIV Congress be placed in hands of incoming officers. Approved.

(d) Moved to authorize the use of ASSCT funds until such time as ISSCT funds are available. Approved.

(3) Clay Terry, Chairman of the Honorary Membership Committee, with Gilbert Durbin and Minus Granger, committee members presented the following names for election to Honorary Membership:

(a) Carl W. Stewart
(b) Michael J. McNulty
(c) Wilmer M. Grayson
(d) Fred Gayle

Approved.

(4) President Allen called for a moment of silent prayer for deceased ASSCT members. Those listed were: E. L. Klock, Linton Richard, Joe Pugh, Jules Lorio, Randolf LeBlanc, Dayton C. Bolin.

The meeting was recessed for lunch. At 2 p.m., President Allen convened the afternoon session. He presented Minus Granger, Chairman of the Agricultural Section, who in turn presented the following program:

Future Equipment for the Sugar Cane Industry	Walter J. Landry General Sales Manager J & L Engineering Company Jeanerette, Louisiana

Specific Cost Data Relative to Bulk Handling of Sugar Cane	Glenn R. Timmons Economist American Sugar Cane League New Orleans, Louisiana
Principles and Techniques in the Application of Sugar Cane Herbicides	W. P. "Bill: Fussell Sales Representative Bel Chemical Company Schreiver, Louisiana

Chairman Granger presented each participant a certificate in appreciation for the presentation.

The meeting was then adjourned.

The Annual Banquet got underway at 6:45 p.m. Invocation was given by J. A. "Pete: Dornier, Jr. Past officers (1967) were introduced as were several special guests. Mr. Skillman, representing the Mayor, presented a special certificate to Herman Mertens for Robert Shields. Mr. Herman Mertens then addressed the group on behalf of Mr. Robert Shields, our announced guest speaker. Mr. Mertens serves as Director of Information and Public Relations and Mr. Shields is a Vice President of the U. S. Beet Sugar Association.

President Allen confered Honorary Membership to those elected at the business session (listed in minutes of business meeting). Following this, President Allen presented each Past President of the Society with an appropriately inscribed gavel. A gift was also presented to each of the Past Secretary-Treasurers.

President Allen presented Clay Terry, incoming President, who presented Mr. Allen with his gavel as out-going President and then presented the following 1968 officers:

J. A. "Pete" Dornier, Jr.	-	1st Vice President
Minus Granger	-	2nd Vice President
Denver T. Loupe	-	Secretary-Treasurer
Preston H. Dunckelman	-	Chairman, Agricultural Section
John Seip	-	Chairman, Manufacturing Section
Frank L. Barker, Jr.	-	Chairman-at-Large
Thomas Allen	-	Immediate Past President

Respectfully submitted,

Denver T. Loupe
Secretary-Treasurer

MINUTES, SUMMER MEETING

AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS

June 6, 1968

The Summer Meeting of the American Society of Sugar Cane Technologists was held on Thursday, June 6, 1968, at Peltier Auditorium, Francis T. Nicholls State College, Thibodaux, Louisiana.

The meeting was called to order by President Clay Terry. After a few brief opening remarks he called attention to the death of Dr. Arthur Keller. President Terry called for a moment of silent prayer in memory of Dr. Keller and other deceased A.S.S.C.T. members.

Dr. Jack Stanly, Dean, College of Agriculture, welcomed our Society to the Nicholls Campus for our Summer Meeting. He also presented members of the Agriculture class who were in attendance.

President Terry introduced Dr. John Seip, Chairman of the Manufacturing Section, who presented the following program:

1. Increasing Milling Extraction With the Screw Press	John Dillon The French Oil Mill Machinery Company Piqua, Ohio
2. Problems of Water Pollution in the Louisiana Raw Sugar Industry	Robert A. Lafleur Executive Secretary Louisiana Stream Control Commission P. O. Drawer 9055 University Station Baton Rouge, Louisiana

Following a coffee break and beginning at 11 a.m., Mr. Terry introduced Mr. Preston H. Dunckelman, Chairman of the Agricultural Section, who presented the following program:

1. Evaluation and Timely Utilization of Sugar Cane Varieties — Dr. George Arceneaux, Director, International Research Service, Pass Christian, Mississippi

2. The Biodegradation of Ligno-Cellulose of Sugar Cane Waste — Joe B. Bradburn, Gulf South Research Institute, New Iberia, Louisiana

A brief business meeting was called by President Terry.

Mr. W. S. Chadwick gave a brief report on the XIV Congress, I.S.S.C.T., to be held in Louisiana in 1971. Officers for the XIV Congress are:

General Chairman:	William S. Chadwick New Orleans, Louisiana
General Vice-Chairman:	John L. Clayton Queensland, Australia
General Secretary-Treasurer:	Denver T. Loupe Baton Rouge, Louisiana

President Terry announced that the Annual Meeting was scheduled for February 6, 1969, in Baton Rouge, Louisiana.

A report concerning an Arthur Keller Fund was presented.

The meeting was adjourned for lunch at the American Legion Building.